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THE SEVEN DIAGRAMS,

A PRACTICAL LESSON IN

PLANTATION POLITICAL ECONOMY.

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Baltimore, Maryland
BOOKS BOUGHT & SOLD

THE SEVEN DIAGRAMS,

OR A

PRACTICAL LESSON

IN

PLANTATION POLITICAL ECONOMY.

SECOND EDITION

WITH A SUPPLEMENT CONTAINING INTERVIEWS WITH A FEW OF OUR COUSINS OF THE LARGE BUT, IT IS TO BE HOPED, NOW HAPPILY DECREASING FAMILY OF THE MOSIES.

BY A MECHANICIAN OF LOUISVILLE.

"* * * it is, we think, allowable to believe that improved gin-houses will be the harbingers of improved plantations, and that these again will be the harbingers of our 'New South.'"

LOUISVILLE, KY:
JOHN P. MORTON AND COMPANY.
1872.

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PREFACE.

Easter Sunday, Anno Domini 1872.

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AN INTERESTING CORRESPONDENCE.

OFFICE ARKANSAS STATE AGRIC'L AND MECH'L ASSOC.,
Little Rock, Ark., August 10, 1872.

WILLIAM DEERING, ESQ.,
Superintendent Deering Plantation Machine Works, Louisville, Ky.:

DEAR SIR,—I have recently read a book called the "Seven Diagrams," written by a mechanician of your city, with which I am much pleased. If you know him give him my compliments, and say to him that I am sure that every member of the Association of which I am President will join me in saying that his work is, for us planters of the South, a timely and useful publication. And please also suggest to him that when he is called on for a second edition he should amend his title-page. In the title "Waverly, or Sixty Years Ago," the second title "Sixty Years Ago" covers the main pith of the book, while the name "Waverly" is but of secondary consideration. But the chief value of the work of our Mechanician is under the first title, "The Seven Diagrams," and the title "Improved Gin-Houses" does not only not necessarily come under the first, but it and all that is said under it is of secondary importance. Those simple demonstrations, showing us the grievous loss to which we have thus far too generally subjected our mules, would be of incalculable usefulness, though he had never said a word about "Improved Gin-Houses." Under those Diagrams he has given a lesson in political economy which is of more immediate usefulness to us planters than the more universally applicable works of Smith and Mill. I would respectfully suggest therefore, for his second title, the words: "A Practical Lesson in Plantation Political Economy."

But far be it from me to say that the part of the book which treats of improved gin-houses is of no, or even of small, importance. I am so far from this that I intend to propose to our Directors to put up a house after his plans next season, on our fair grounds at Little Rock, as a full-sized model gin-house, to be exhibited by us for the benefit of the patrons and members of our Society who may visit us during our exhibition of 1873; and one purpose of this communication is to ask you to give me an estimate of the cost of the workmanship necessary to its erection. Mr. Mechanician, in his appendix, has given us the quantity of the material, the cost of which delivered on our grounds I can myself ascertain; and now I hope you will oblige me by sending me as soon as convenient the cost of the labor and carpentry.

I understand all the book but the preface. That to me is an enigma. Please give me, if you can, its interpretation.

I am, dear sir, very respectfully yours,
D. E. JONES,
President Arkansas State Agric'l and Mech'l Assoc.

COUNTING-ROOM DEERING PLANTATION MACHINE WORKS,
Louisville, August 15, 1872.

D. E. JONES, ESQ.,
President Arkansas State Agric'l and Mech'l Assoc., Little Rock, Ark.:

DEAR SIR,—Your esteemed and interesting favor of the 10th inst. duly received. Mr. Mechanician accepts and thanks you for your compliments. He asks me also to thank you for your discriminating criticism on his title-page, and to add that he will adopt your amendment in the second edition, now being made ready for the press. He bids me say to you, furthermore, that since he wrote the book he has come to the conclusion that in cases in which the lumber, as under its appendix, is to be sawed and not hewed, eight by eight inches will be large enough for the posts, and five by ten inches for the girders, provided that cleets made of sound board, an inch and a half thick and two or three feet long, be spiked on the posts for shoulders for the girders, and pieces an inch thick and twelve inches long nailed on the girders for shoulders to face up against the posts. He gives his assurance that good cleets, well spiked on the posts and

nailed on the girders, will be just as reliable as shoulders gained into the timbers with saw and chisel, as in the text; and taking into account the lesser lumber and labor required, these will, he says, considerably lessen the cost of the gin-house. In reference to those partitions on the gin-stand floor, and in reference to a plan suggested to him to put a floor for the seed-cotton on the principal rafters over the gin-stand floor, he says that each planter should study the matter deliberately, then follow his own judgment, and arrange everything within the outer walls of the house to suit himself. In any case of putting in a second upper floor for the seed-cotton, the gin, he says, would probably have to be moved to the other end of the house, and have the lint-room in front of it on the same floor. In this case he thinks a partition might be run through the house, parallel with and just along over the inside line of the engine-pulley. The corn-mill might then stand about N in figure C, and the belts of both mill and gin be made to run close along on the outer or right-hand side of that partition. Then by building a light pulley on the arms of the pulley proper of the engine, one of those very useful small-sized cotton-seed hullers, he continues, might be run close up to the partition, and just enough to one side or the other to give it a sufficient length of belt. He says useful cotton-seed hullers, because he is assured by good men that one bushel of hulled cotton-seed, properly fed, is worth more than two bushels of corn; and this, he concludes, is a new and important item in plantation political economy.

In reference to the workmanship of the gin-house, I think I can safely assure you that with a good foreman it will not cost over two hundred, or at most two hundred and fifty dollars. Your idea of building an improved gin-house on your fair grounds as a pattern for the planters of Arkansas is an excellent one; and would it not be a good supplementary idea to supply it with a horse-engine, so that corn-mill and cotton-gin manufacturers can exhibit their machines in operation, driven by the same power—the muscle of mules—by which they are driven generally on the plantations? The driving of these machines by steam-power at our Fairs may be or may be made so easily deceptive that I think all honest manufacturers, as well as all planters, would hail such an improvement with gladness. And now, to follow the advice of St. Paul and be zealous in well-doing, I propose for myself and associates in these Works, Messrs. GEO. W. WICKS & Co., to supply your model gin-house with one of my No. 3 horse-engines, to be used permanently in that gin-house for that purpose.

In answer to the paragraph which closes your communication, Mr. Mechanician bids me remind you that Easter means Rising—Rising up; and that his preface is therefore an adumbration of the rising up which it is hoped we are now all working for over our beloved South.

I am, dear sir, very truly yours,

WILLIAM DEERING.

LITTLE ROCK, ARK., August 21, 1872.

WILLIAM DEERING, ESQ., Louisville, Ky.:

DEAR SIR,—Your very kind favor of the 15th, in answer to mine of the 10th inst., now lies on my table. I like those suggestions of our Mechanician which lessen the material and the cost of the carpentry of the outside or principal frame-work of his gin-house. His words and your words, and particularly the generous offer of yourself and associates in making us a donation of one of your No. 3 horse-engines, strengthens my hands, as I contemplate laying this matter before our Directors, who I believe will co-operate with me so heartily that next year will see this matter carried into full and beautiful fruition.

Now I know what is meant under that preface, and feeling a little of the quiet enthusiasm of our Mechanician, I will hope that in that part of the Rising up to be thus instituted by our Association we shall be but pioneers.

With sincere thanks, not forgetting that every member of our Association will by-and-by join me in these thanks for your liberal donation, and with faith that we will be in good time able to avail ourselves of its usefulness,

I am, dear sir, very respectfully yours,

D. E. JONES.

THE SEVEN DIAGRAMS,

OR

IMPROVED GIN-HOUSES.

The reasons which point to the necessity for improved plantation office-houses are of two classes: *First*, those which exist in the promptings which underlie the advance of civilization; and *second*, those which are suggested by the immediately and practically useful.

The reasons of the first class lie rather outside the province of men of immediately practical conceptions, and belong more specifically to the philosopher. Nevertheless, some of us practical men sometimes indulge a little in philosophy; and so, by an easy analysis, many a manufacturer concludes that if his machines fell into proper places in proper houses they would be much more likely to give the required satisfaction. So too a thoughtful man of any occupation, after passing through a district in Indiana destitute of barns, and with but open hovels for stables, and then through one of those rich districts in Pennsylvania, dotted with farm office-

houses comparatively like palaces, would irresistibly come to the conclusion that in the world of husbandry the people of the first district are a long way behind the broad and beautiful advance of the people of the second.

I will not speak of the farm office-houses of the South generally; but, that I may give an evidence which will introduce that immediately and practically useful with a greater impressiveness, I will speak freely, but I hope kindly, of a single plantation which I visited during a cold week in February.

It had no sheep-cots, but a number of dead lambs; no sties, but in the evening a litter of eleven, out of which next morning there were nine frozen pigs; no byres, but a crowd of raw-boned, sickly-looking cows; no stables, but a frightful looking hovel of logs, with openings between them through which foals could suck their mothers, without a door worthy of the name, and with layers of manure three feet deep for beds for the long-haired, dirty-looking, shaggy, shambling mules; no implement-room, but shams in shape of one-horse plows rotting in the fence-corners; neither barn nor granary, but a little "fodder" losing its little remaining virtue in loose heaps, kept from the hungry cattle by ugly fence-rails. It had no proper gin-house, but in its place an insane strata of immense logs, dribbled by some uncouth giants in a horizontal row, nine feet from the ground, on the tops of upright—or nearly upright—24-inch diameter butts of trees. These were covered with a roof with eaves springing from themselves, and ending in a comb high enough to show that it contained

material to make, in addition to a roof proper, a comfortable second story for the gin-stand. Under these logs I found a decayed running-gear and six mules on it, doing the work that under fair conditions could have been done as easily by four. The axle of the running-gear had mortices for four levers. Two mules were on each of two of these, and one mule on each of the two others. One boy tottered behind each lever, making four boys freezing under, that day, a bitter north wind, blowing unobstructedly through that miserable open quadrangle. Up stairs—if I might say stairs in connection with a place about which there was nothing worthy of the name—were two other boys as attendants on the gin man; and the gin man, with his gin shrieking in the darkness under that low roof, through whose ragged imperfections the icy winds grated round their shivering bodies. I said shrieking because, as I climbed the crazy ladder, I heard a noise which I knew to be not simply usually but dangerously abnormal. I steadied myself past several openings gaping down into the mule-room, and as I approached the gin bumped my beaver against a purloin; and then in no very good humor grasped the man by the shoulder, and ducking my head, as well to avoid another bump as to reach his ear, I said:

"There is something in your gin, uncle."

"I reckon not, masser; I reckon the gin 's all right," he responded.

"I tell you there is something—a nail or something; you had better look," I reiterated. I should, however

have said you had better feel, for in that miserable dirt and darkness the eyes were next to useless.

The mules were stopped, and after some fifteen minutes started again, without anything having been discovered. As I desired to see the result without my intervention, I did not myself join in the examination; but after a few minutes, and while he was again ginning with a full roll, I asked him to let me search, and his answer was a call to the boys to again stop the machine. This I prevented until the saws, being driven through an empty gin-breast, the objectionable sound grew audible to him, as well as more audible to myself.

"Yer right, masser; there is something in her, sure," he said; and again shouted to the boys, searching at the same time in his pockets for a match. By this time my ear, however, had detected the exact place of the obstruction, and a fragment of an old harness buckle was found wedged between two of the grate-bars. I thought then of the perhaps certainty of that gin-house having been within the hour reduced to ashes had it not been for the accident of my intervention, and reflected that it is no wonder insurance companies charge seemingly exorbitant rates for policies on gin-houses.

Very soon the owner of the plantation came in, and, after the usual salutations, the following conversation passed between us:

Visitor (*holding up the piece of buckle*). But see, sir, what my ear detected in your grate-bars.

Planter. Yes, sir; but why did n't the ear of the confounded negro detect it?

Visitor. Because in the first place his senses are benumbed with cold, and in the second place this twelve inches in depth of dirt and cotton-seed under and around his feet and gin-stand are the worst possible conductors of sound. Indeed it would seem as though everything here, including this low rough roof, was intended to war against the ears, and to cause flames which could have been made next to impossible by a little attention to the useful principles of acoustics.

Planter. By the Lord, sir, you are right! That is a new thought to me, and it is a wise one.

Visitor. Looking in the same direction—as against fire—have you ever thought of the importance of good light on your gin-stand?

Planter. I am ashamed to say I have not, sir.

Visitor. And just now this man spent a quarter of an hour searching for a possibility, which he at last concluded existed only in my brain, and again started the gin to probably burn up your house; while had he had a fair light on the machine, he would without doubt have found the buckle, and removed the probability, and indeed also in this case the possibility, of that destruction.

As, a few minutes subsequently, we passed out of the gin-house, two of the boys, with watery and averted eyes, were warming their outstretched hands over a fire of chips flickering about fifty feet to the windward.

Planter. Put out that fire; put it out. Do n't you see, you noddle-heads, that the wind is blowing it toward the gin-house? Stamp it out instantly.

Gin man (*poking his head through a hole in the roof*). Masser John, dem dar boys is doin' nothin' but warmin' 'emselves all dis mornin'. Dey do n't drive de mules worth a cent. Dis chile won't gin two bales all day wid 'em drivers.

Planter. Boys, I do n't want to scold you, but I must say plainly that if you do n't attend to your mules you shall go to bed to-night supperless.

Visitor (*speaking on the philosophy of relieving the horse by putting the severer burden on the coarser anatomy of the ox*). Would it not be better, sir, to have those mules driven by black boys?

Planter. Black boys are worthless without the switch. We can not now use this, and therefore are obliged to use white boys or black men. The latter are too costly, though on a day like this I would rather stand this than subject my sons—for two of those boys are my own—to such hardship.

Visitor. The mule-walk on the side of the lint-room is already closed; how much would it cost to close the three other sides?

Planter. I am sure I do n't know; I have never thought of making the calculation.

Visitor. Let us then, if you please, make it now. Three sides of the house make, outside, say 32 and 32 and 32, equal 96 feet. One 12-inch wide 16-foot long board, sawed across into two pieces, should inclose 2 feet of these 96 feet. This will call for 48 such boards; and 16 times 48 will make * * * 768 feet. Then we must have 96 feet in length of 3 by 5-inch stringers to nail

the lower end of the boards to. Three times 5 make 15, which makes a foot and 3 inches in each foot of these stringers. This will give us * * * 120 to be added to the 768, which will make in all 888 feet of lumber. Call this two cents a foot, and we have $17.76, to which we will add one dollar for nails, and one dollar for hinges and hook for a door, and we have $19.76; to this we will add twenty cents for a piece of board for door-battens, which will give us exactly even twenty dollars. But to make the thing complete we must add four 8 by 10-inch pane nine-light half windows, worth, boxed and delivered on boat or cars at Louisville, five dollars—worth delivered here say seven dollars; thus making in all twenty-seven dollars and a day's work of a couple of men, and we have an inclosed house in which boys and mules can work all winter comfortably.

Planter. You make me serious, sir. Many a time I have spent that amount foolishly simply because I thought I had no particular use for it, while had I put it to the service you speak of it would have saved my boys many an hour's suffering. I presume our half windows should be put in sliding fashion, so that on warm days they can be pushed aside, and give, together with an open door, all necessary ventilation.

Visitor. Exactly, sir; those half windows put in in that fashion is a necessary complement to the improvement.

* * * * * * * * *

During the evening of that day the weather changed. The next day it rained heavily, and on the following or

third morning of my visit I saw the gin-house in the middle of a quagmire. My friend went on this side and then on that, and at last stepped in, called on me to follow him, and we landed on a short log just outside the mule-track, with feet and ankles, almost to our knees, glazed with mud, pig-manure, and rotten cotton-seed. The boys sat on the levers, holding up their feet, while the mules' feet, up to the fetlocks, were in one part of their circuit splashing through slush, and in another part making vacuums under their shoes almost sufficient to break their legs, as with bent necks they tugged through clay worked into putty as viscous as thick bird-lime.

Planter. Well, sir, I may presume you don't think much of this arrangement.

Visitor. I presume I think of it exactly as you think yourself. You are at this moment, without doubt, thinking that this mule-track should be, in some way, raised solidly above the level of the outside; and you put in the qualification solidly because you know that a raising by cotton-seed or any such thing would yield under their feet, and so call for a proportionally increased strain on their muscles to propel the machinery.

Planter. No, sir; I have never thought of that last. Indeed, so far from it, I had intended to fill up this place this Spring with chips and cotton-seed; but, on the wise thought you have just given me, I would now clean it out till I reached the subsoil, then cart in the hardest subsoil or gravel I could find on the plantation. This moment, however, I purpose to do neither of those

things. After our talk of last evening I came to the conclusion, during the night, that slip-shod is slip-shod forever—poverty, or something worse than poverty, to eternity. This house, or hovel, is twelve years old, and is, I may presume, in a more tumble-down condition than a wisely-planned house would be at fourscore. I can not think that, even with another patch-work, it would last over two more years. I will now then make a virtue of an almost necessity, and put up a new gin-house as soon after this Spring's plowing as possible. And now, sir, I ask you to consider that, whatever I am or may be in other directions, I am in this item of building and machinery simply a simpleton. Let us go back to the house then, and once there by the fireside, I beg you to say to me plainly just whatever you think you should say under my anxiety to learn, and under the circumstances.

* * * * * * * * *

An hour subsequently, seated before a cheerful fire, our conversation continued as follows:

Planter. Now then, sir, I shall be glad to hear you speak fully. Do not stint your words. We have plenty of time. Speak then in every direction you think proper, and be assured I am prepared to be interested.

Visitor. I thank you for your invitation to speak in any direction I may please; because, before I say any thing on our subject proper, I want to say a word on that state of ignorance in which you so frankly acknowledged yourself. I say frankly, because I have met so many planters who unmistakably acted as though it

were beneath them to know anything about machinery. These were not simply simpletons; but were, if I may so speak, beautifully beautiful quiddanies. In an age in which the machinist has given us a loom which of its own action weaves the flowers of all countries and the designs of richest souls into its embossed and embroidered products; in an age in which he has given us the spinning-jenny and the cotton-gin which, for a new way-mark in the world's history, have made it possible to cultivate cotton for the universal and most comfortable clothing of our race; in which he has given us the machine which has quieted the fretted muscles of those tens of thousands who a few years ago sweltered under July suns, swinging scythes and sickles; has given us the printing-press, the steam-engine, the locomotive, and those instruments which make it possible to manipulate the lightnings; in an age in which machinery is making mankind familiar—mark you, sir, my word familiar with a 'Positivism' perhaps not much thought of by Compte, a 'Positivism' which is destined to be the real remover of Superstition, and to introduce at last a 'Positivism' in theology which will make Superstition and its curses for evermore impossible. O sir, for the men, preachers as well as planters, who innocently look down on machinery as belonging to the inferiorities; is n't it delectably delicious?

But to return to yourself. Your ignorance is by no means, as you think it is, the consequence of an inability on your part to understand. I remember when, in my young manhood, I went as a tyro into a machine-shop,

I thought there was something occult under every gear, every lever, every pulley, every eccentric, every movement; and each time my delicate fingers were a little hurt I felt as though an unseen gnome was in that way punishing me as an intruder; and then suffered under an almost irresistible impulse to fall back to strivings in a less concrete manufacture. But my purpose strengthened me, until in good time the fancied mysterious vanished; and then, my proper self coming to my aid, I was soon relieved from manipulations which probably I could not much longer have endured.

It is not, sir, without a purpose that I speak thus, for a moment, autobiographically. I would illustrate your condition by a state which was once my own; and now that I am out of it I would speak back through those old vapors that still surround you, and assure you that, apart from the powers which move it, there is nothing esoteric, nothing hidden about machinery except to the imposed upon and to the ignorant. When I say imposed upon, I do not mean by impostors, but by impressions. When I was a boy, the work done by a shoe-maker was curious; that done by a carpenter, surprising; that done by the man who made water-wheels, astonishing; that done by the watch-maker, amazing; and that done by demi-gods who made steam-engines was overpowering—before these last I stood silent, speechless, awe-stricken. And now, sir, as it was with me, only probably in a lesser degree, it is to-day with perhaps nine tenths of the planters of the South. There is something the matter with your running-gear, your corn-mill, your gin-

stand. You think, with a thought that rules you, that you know nothing about these things. You are pothered; you are confounded. Then you jerk, and call up a negro and send him ten miles for a gin wright. He comes; he looks wise; he knits his brows and looks profoundly interested; but, though he can more or less coarsely or finely manipulate wood or iron, he is probably profoundly ignorant. You think that you are ignorant, and, still worse, you think you can not understand, and so you stand by blindly while he innocently does something which, with more certainty than it lifts you out of a rut to-day, puts you into a ditch next month, and into a morass the month following.

I think you now know to what conclusions I would lead you, and I need not unduly continue this subject. In the first place, you have but to resolutely banish the thought that there is anything about machinery which is not susceptible of easy demonstration. Then your general knowledge, your general education, and your general intercourse with other men of general education will come gradually to your assistance, and in good time you will find yourself in possession of an ever-ready mechanical intuition, which will make you a sovereign where before you were a slave and a victim, and too often, however innocently or indirectly, yet virtually, a destroyer.

With these remarks for your future consideration, I will now remind myself that you contemplate building an improved gin-house, and that you request me to say whatever I think I should say under the circum-

stances—or rather under those, over yonder in the quagmire, surroundings.

Planter. But first let me say a word apropos of what you have been saying. Some two years ago I bought a gin-feeder. An agent for its introduction put it into operation, and it worked so beautifully that I paid him for it—I think some seventy-five dollars—immediately. It was really a nice thing, and I was charmed with its usefulness. After a few days, however, it ceased giving satisfaction. I sent—not ten miles, but twenty—for our friend the ginwright; and faith, sir, when he saw it he did look wise. Now that you have opened my eyes a little, I can say that he looked at it like a duck squinting at hailstones. Well, sir, the result was that after a couple of days tinkering he pronounced it a wooden-nutmeg affair; and after being kicked about some nine months it was used up one fine Sunday morning by one of the negro families to help to cook their breakfast. Three dollars for the negro messenger, four days, being twenty dollars, for the ginwright, in all twenty-three dollars additional, to the dickens.

Visitor. And what is your thought now about it?

Planter. I now think what I should have thought before. I think if it fed satisfactorily one day, it could have been made to feed satisfactorily a thousand; that if I had then entertained this conviction, and then exercised a little patience and a little determination, I would in good time have discovered and removed the difficulty.

Visitor. Or, if you could not have removed it yourself, you could have written to its manufacturer exactly

what was the matter with it, and he doubtless would have been glad of the opportunity to have made whatever necessary improvements.

Planter. Then too I have a corn-mill, stowed somewhere away among the cobwebs, which has n't ground an ounce in three years, and it is but four years since I paid two hundred dollars for it at the manufactory.

Visitor. Well, sir, we will hope for better days in the future; and now, if you please, we will go on with our work proper.

The first thing that strikes me about your gin-house, apart from dilapidation, is that your gin is much too close to your running-gear, and that your mule-circuit is too circumscribed. How long are your levers?

Planter. I believe fourteen feet, measuring from the center of the power to the draught-hooks.

Visitor. And you think your mules have the benefit of sweeps of fourteen feet radii?

Planter. If the measurements are correct, I may presume they have that advantage.

Visitor. The measurements are doubtless correct, and yet they have not that advantage. How large is your house across, from post to post?

Planter. Thirty feet; but the last ginwright who was here notched well into the posts to let the swingle-trees pass.

Visitor. He might as well have notched into the moon. Suppose we stop the machine at the moment the swingle-tree enters that notch, and then turn the mules' heads toward the center; how much would their

pulling do toward revolving the cotton-gin? The draught-hooks mark a circumference of twenty-eight feet diameter. To have the full benefit of this with one mule on the lever, the center of that mule's breast must always keep exactly over that circumference, and so half his body must have space to keep always outside of it; and yet in your house we have but twelve inches between it and the inside face of the post. I know it is possible for the body of an ordinary mule to pass through a space of twenty-four inches, but we can not make any mule walk close enough to that post to keep half his body outside the line of that draught-hook; and then in proportion as he turns inward we lose a proportion of our lever. But think how much we increase this evil when we put on two mules. With one mule the line of draught is through the center of his body; with two mules this line is shifted to a point midway between them. In your house, though the animals keep out as much as possible, half the body of the outside and the entire body of the inside mule are inside the proper circle; the line of draught is therefore over points some fifteen or more inches inside that circle, and the effective length of your lever is still more materially shortened; in fact it is shortened to a point at which two mules are not much better than a single one on a lever of proper length, properly harnessed, and pulling in a proper direction.

Planter. A few minutes ago I felt as though those vapors you spake of were dispelling; now I feel that they are returning. You said, a short time ago, that

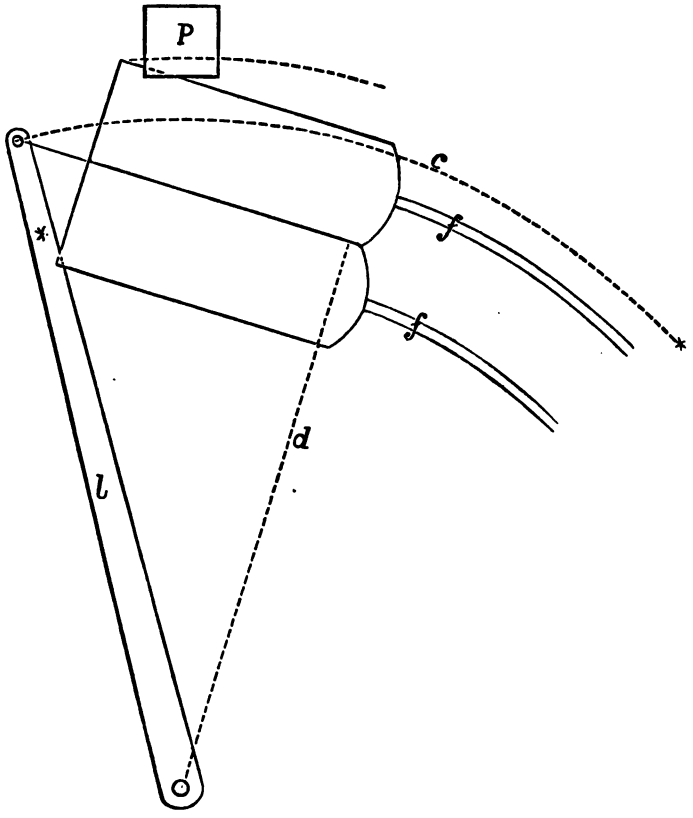
there is nothing occult about machinery; but certainly you now tell me something not only that I never thought of, but also that I find myself unable to understand.

Visitor. I said, apart from the powers which move it, there is nothing occult about machinery; and I will now add that, at least up to certain points, there is nothing occult even about these. I am aware that this subject of levers, and the directions through which powers are applied to them, may seem occult; but if you will have the goodness to now let me have my valise and leave me some hours alone, I will make a few diagrams which will demonstrate to you, as plainly as that 2 and 2 make 4, that the mules, as now in your gin-house, are working exceedingly disadvantageously.

* * * * * * * * *

Our next meeting was in the evening after supper of the same day. We sat down by the same fireside, and at a table on which lay seven diagrams, as explained in the following conversation.

Visitor. Here is diagram No. 1. In it we have the position and direction of your mules as now working. L is the lever, drawn on a scale of a quarter of an inch to the foot; and *c*—all of course drawn on the same scale — is the line of the circumference described by the draught-hook, or rather I have made it in these figures the draught-pin. P is the post into which you have notched for the swingle-tree, and from which the animals have to turn inward until their feet travel on the curves *f f*, and until their line of draught is



No. 1.

thrust into the direction of this star you see on the outer circumference.

An ounce will not move an ounce, because an ounce against an ounce makes simply an equilibrium; but an ounce and some small fraction of a drachm will move an ounce. It is, however, a law, or perhaps, more properly speaking, a fact or property, in the world of matter and force, that the ounce and whatever minimum required to break the equilibrium can not move the ounce until it is brought against it in a line at right-angles to the resistance. The resistance in the case before us may be considered as in the lever, and, looked upon as for two mules, may be taken under a reasonable estimate as four hundred pounds. If then we apply four hundred pounds to the draught-pin, through a line at right-angles to the lever, and then add whatever fraction necessary to overcome the equilibrium, the lever will move and continue to move as long as we keep the line of the application of our power in the same relative direction; but the instant we change that line into a direction, even a single degree from the right-angle, the lever will stop, and, though we apply our power till doomsday, will never more move a hair's-breadth. A right-angle is, as you know, an angle of ninety degrees; but on this diagram you see the mules are thrust inward until they are pulling on an angle of—in the absence of a protractor to enable me to speak with certainty—I will say sixty degrees.

Planter. As the mules are now pulling, do we indeed then lose one third of their power?

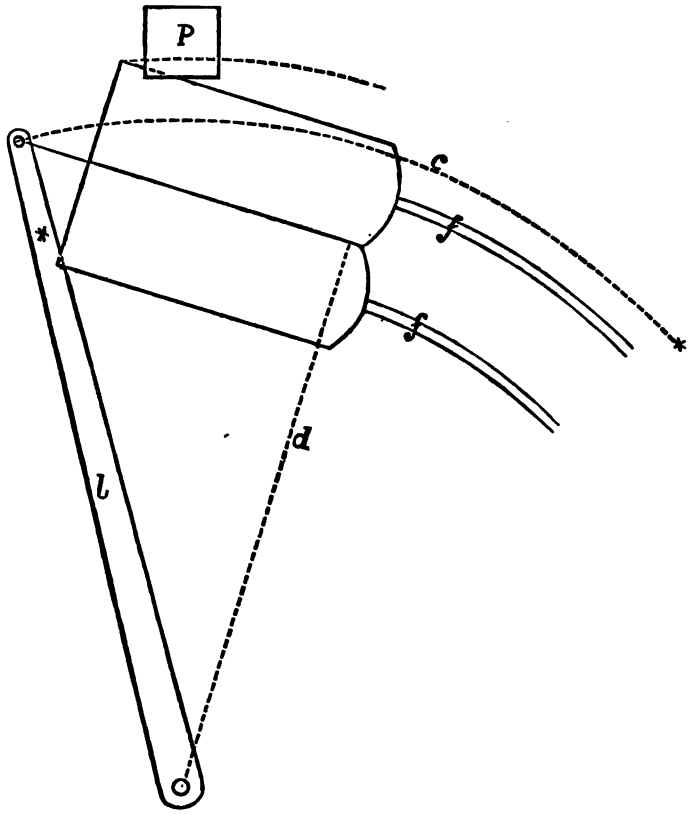
Visitor. As the thirty degrees variation is one third of ninety, that would seem to be a natural, but it would not be a right, conclusion.

Planter. I am growing greatly interested. I want to come at our loss. Pulling, as I now see, on this abnormal angle of sixty degrees, how many pounds more than the four hundred do we require to move the four hundred in the lever? If we can not measure by the difference in degrees, how can we measure?

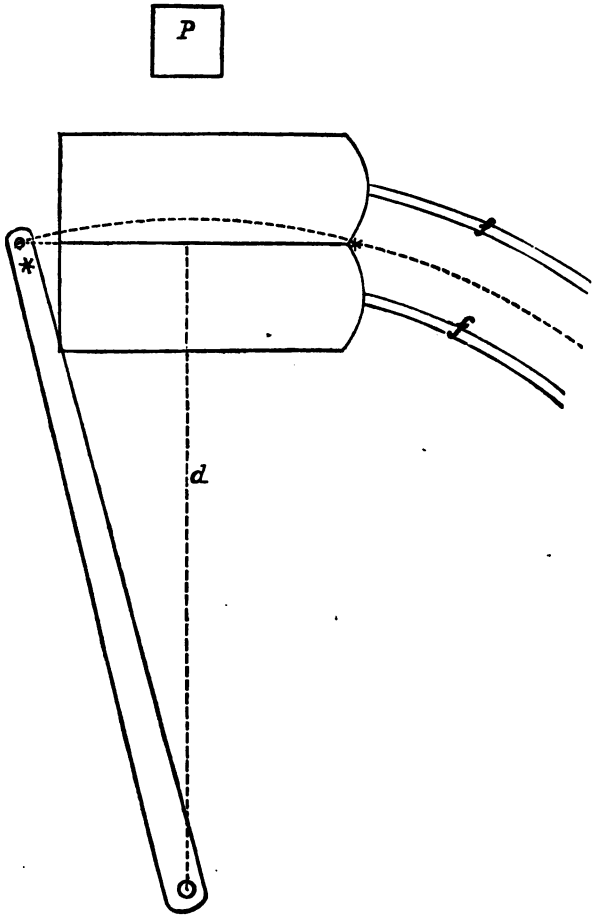
Visitor. You are asking the very questions I would have you ask. I said that in the case before us the resistance may be considered as in the lever. In reality, however, it is not in the lever, but in the axle-tree of the running-gear, and into this we must again follow, and discover it in its center of gravity in the center of that axle-tree. Now then, to answer your question, I have but to project a line from this center at right-angles to the line of the application of our power, and to continue this line until it touches that line of application.

Planter. I see, sir; I believe I understand. That is this dotted line *d* which runs from the center up to and, as I now perceive, at right-angles to this line of draught midway between the mules; and the loss of power is the difference between the length of this line and the length of the lever, measuring from this same center out to the draught-pin

Visitor. Exactly so. Please pass me those compasses. Thank you. Now then we take the instrument and fold this dotted line up on the lever, and find that its end



No. 1.



No. 2.

touches the lever where you see this star; and so we see that our loss is the space between the star and the draught-pin. This, according to our scale, is quite twenty-four inches; and so we demonstrate that our lever of supposed fourteen is in reality but one of twelve feet.

Planter. That, sir, is an exceedingly useful demonstration. And now, if you please, how many additional pounds have we to apply? What is the amount of evil we inflict on our mules in pounds avoirdupois?

Visitor. Pardon me a little. We will first, if you please, go through with these diagrams, and then finish with arithmetic. This will avoid repetition, and in the end will be more satisfactory. You find you are not now simply a simpleton.

Planter. Whether I am or not, I know I am intensely interested—interested enough to sit with you all night if you please.

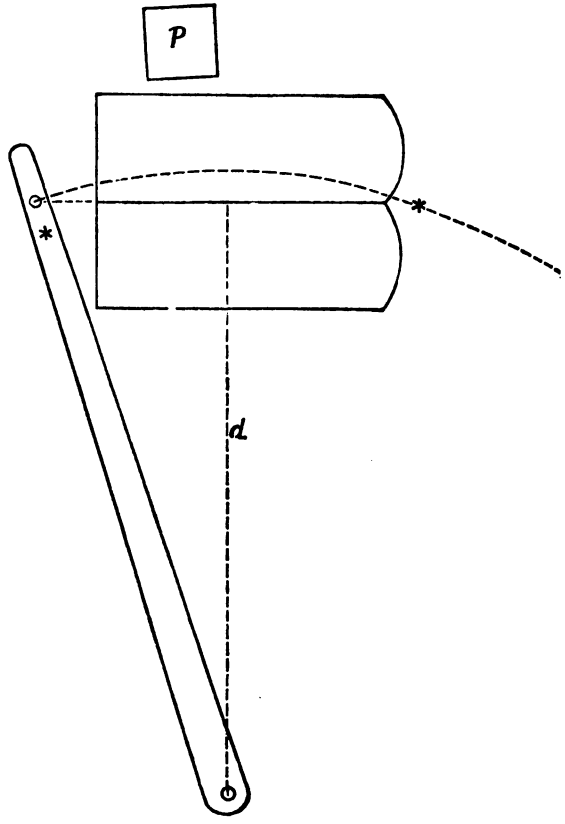
Visitor. We will now then take up diagram No. 2. Here you see I have moved the post out some two feet farther, thus making the house, as it should be for fourteen-foot sweeps, thirty-four instead of thirty feet clear inside. The lever in this diagram is still, as in the last, fourteen feet to the draught-pin; but in consequence of the mules having plenty of outside headway, and walking, as you see by the new places of their feet-circuits *f f*, as far out as possible from the center, the dotted line *d* is much longer, and, as you see by the new position of the star on the lever, the loss is reduced from twenty-four inches to seven inches—that is, so to speak,

from nearly one hundred per cent. to twenty-five per cent.

Planter. Good God! That New York philanthropist, sir, should be sent with bills of indictments against every plantation in the country.

Visitor. Now comes No. 3. In this diagram the post is set back to its position as in No. 1, but the draught-pin is moved inward twelve inches, and there is consequently twenty-four, instead of, as in our first case, only twelve inches between it and the post. The levers in your gin-house measure fourteen feet to the draught-pins; but shift these pins inward to thirteen feet, and in this way give the mules twenty-four instead of twelve inches between the pins and posts, and the lengths of your effective levers are at once increased each several inches. That you may realize this look at line *d* on this diagram No. 3. You see that this line is longer by, I think, seven inches than its corresponding line in No. 1. Thus, while your present effective levers are but twelve feet, we demonstrate that by moving the draught-pin and mules inward one foot we absolutely increase their effective lengths to twelve feet seven inches. Now, sir, is n't this as beautiful as it is important?

Planter. Beautiful and important certainly; but I do not feel either of these at this moment nearly as much as I feel my own stupidity. (*Rising suddenly to his feet.*) Some of us in Washington once said "greasy mechanics;" and we at home looked askance at our gin-houses and said "greasy mechanisms;" and, by God, sir, we deserved to be thrashed!



No. 3.

Visitor. I have sometimes thought of that thing. It is something that will inwork itself into a thousand ramifications. But we must make experience a good school-master. Let us then go on with our crankinapennies.

Planter. Our what?

Visitor. Our crankinapennies.

Planter. What is that, sir?

Visitor. Duties taken hold of with an express intention to make a joy for to-morrow that will make us both forgive and forget the evils of yesterday.

Planter. By the Lord, sir, you 're a brick; let us go on with our crankinapennies.

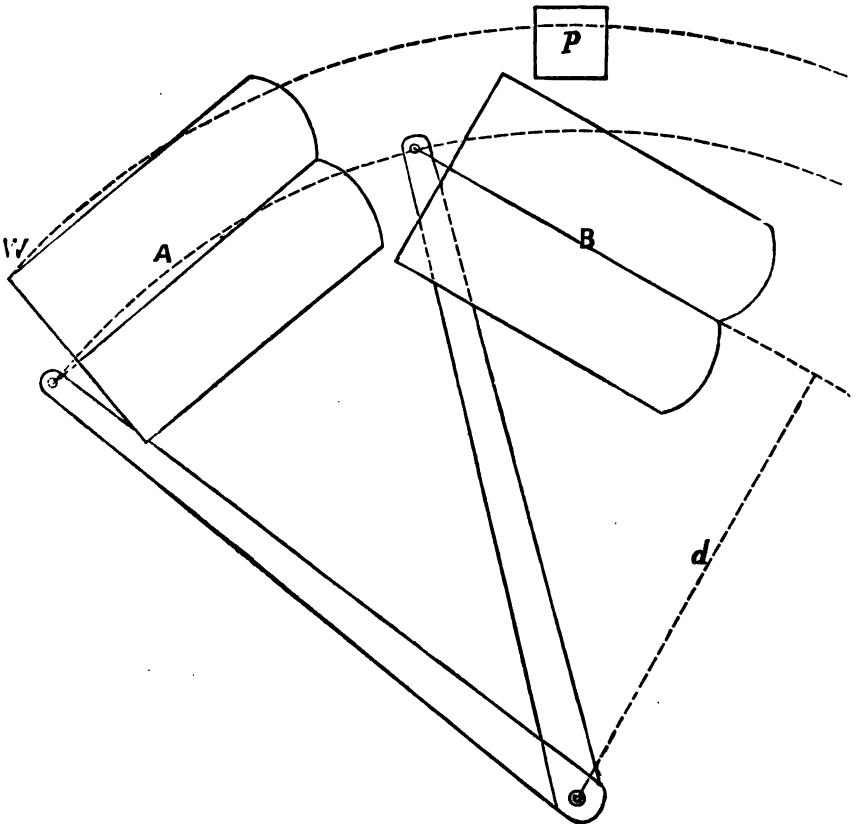
Visitor. Then let us return a moment to our No. 2. Here you see I have drawn the mules up some nine inches nearer the draught-pins than in No. 1.

Planter. I had already noticed that; noticed that you laid down the first some eighteen inches from the pin to the swingle-trees, just about, I think, as it is in my gin-house; also, that you had drawn them in No. 2 but some nine inches distant, and it occurred to me that were I to draw my mules back to the same point it might be of some service similar to a moving out of the post.

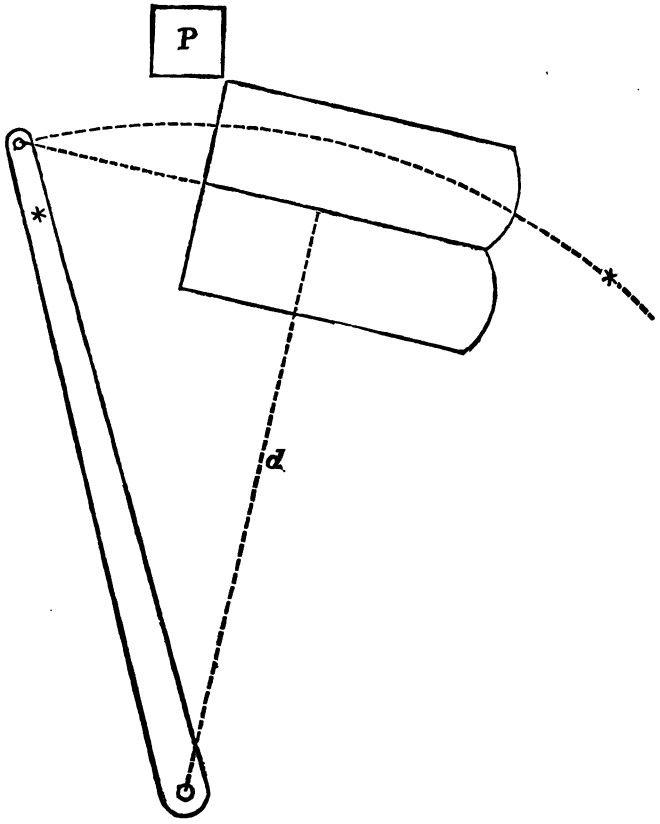
Visitor. Your thought was a natural one. Had any one asked me this morning as to the proper distance of the mules from the draught-hooks, I would have answered, as close to the hooks as possible, and I would have said this too without qualification. A few minutes after I had begun these little geometries I saw, how-

ever, that the true answer must be that when the point central between their collars can keep unobstructedly over the line described by the draught-hook, the mules should be harnessed to the hooks always as closely as possible; but if, on the other hand, this point central is thrust within that line, the harness should on the contrary be lengthened to points corresponding to the radii and the inclinations. Radii and inclinations are, however, just at present somewhat obscure words, and so we will again turn to our diagrams.

Here then comes No. 4. In this the draught-pins and the posts are in the same places as in No. 1—exactly in the same places as in your gin-house. Here you see I carry the swingle-trees back to nine inches, as occurred to you. But in the first position of the mules, as in the division on your left, under letter A, you see that the point of the swingle-tree, as at W, describes a curve which would pass almost altogether outside the post; and as this curve can not be continued because of the post, the mules, that they may pass the post, are constrained to turn inward, as under the division on your right under letter B, until the point midway between their collars is thrust into a direction which shortens the lever, as you see by line *d*, until it is but little over three quarters the effective length of the lever as in No. 2. The mules as now harnessed in your gin-house have effective levers of twelve feet, but under this shortening of the harness these effective lengths would be reduced, as we see in this No. 4, at least twenty-two inches.



No. 4.



No. 5.

But here comes No. 5, in which the point central between the collars is thrown off ten feet; and now the same swingle-tree, attached to the same draught-pin, will pass the same post, and at the same time give the mules an effective lever of over twelve feet. Let us measure. The swingle-tree, as in No. 1, is eighteen inches from the draught-pin, and the line *d* shows an effective lever of twelve feet. The same swingle-tree, as in this No. 5, is forty-six or eight inches from the draught-pin, and the line *d* shows an effective lever of twelve feet and six inches—six inches longer than as in No. 1—six inches longer than as now in the gin-house.

Planter. Please compare it with that in which we have moved the draught-pin in to thirteen feet.

Visitor. See, it is some three inches longer than as in that case.

Planter. Then which should I do in the morning; move inward the draught-pin or move off the swingle-tree?

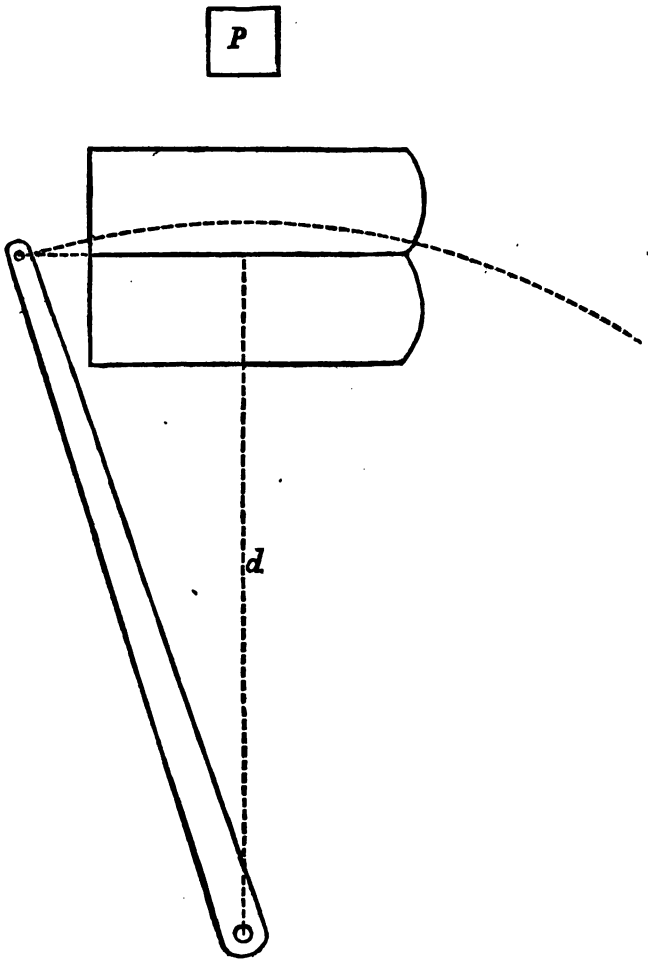
Visitor. What is your opinion?

Planter. I think that the few inches gained in the geometry would probably be more than counterbalanced by the increased elasticity and swinging about of the harness, and that therefore it will be wiser to move in the draught-pins.

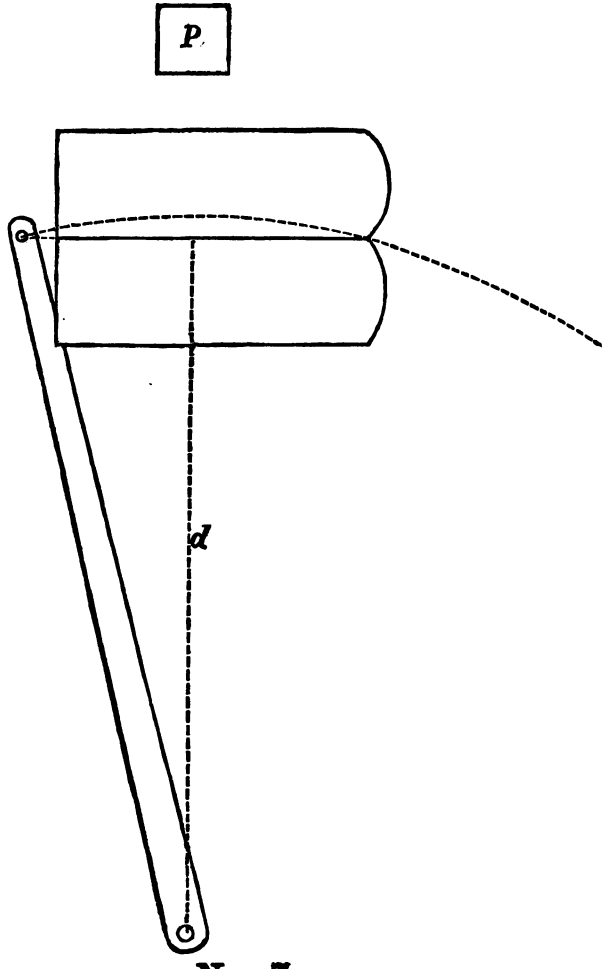
Visitor. You are, I think, correct. Still there may be cases in which it would be wise to lengthen the harness, and we must therefore avoid a general conclusion that they should under no conditions be lengthened.

But we will now pass exceptions, and demonstrate that in all cases in which the mules have proper outward headway, the harness should be as short as possible.

Here then is diagram No. 6, in which we have, as we should always have, a lever with a draught-pin sixteen feet from the center; and in which, that the mules may not be afraid to keep well outward, I have given, as in No. 2, and as there should be always given, thirty-six inches between it and the post. The point midway between the collars can therefore always keep over the right circumference. But in this diagram also I have given eighteen inches between the draught-hook and swingle-tree, and you see that this throws the pulling-point toward a place on the circumference which, according to our line *d*, shortens the effective lever at least ten inches.



No. 6.



No. 7.

Visitor. Now comes No. 7. This represents the same lever and the same house as the No. 6. But in this diagram there is room between the draught-pin and the point of the application of the power barely for the motion of the legs and bodies of the mules. They are in this figure, as in a well-harnessed cart or wagon, close up to the weight as possible. The point midway between the collars now, as you see, touches the circumference but some seven feet from the weight, and the result is that our line *d'* is lengthened to its maximum, and the loss in the lever reduced to a minimum of, it seems by this diagram, not exceeding five inches.

In the No. 1 we have a lever of fourteen feet in a thirty-foot house, with a loss of twenty-four inches, or one seventh of that lever; and in your case, did you not notch deeply into your posts, this loss would be considerably greater.

In No. 2 we have a lever of the same length in a house thirty-four feet between the posts, and the loss is reduced to seven inches, or one twenty-fourth of the lever.

In No. 3 we have a lever of thirteen feet in our original house of thirty feet; and though this is twelve inches shorter than as in that house, we have here nevertheless an effective lever of at least six inches longer.

In No. 4 we return to a fourteen-foot lever in the same house, and by harnessing the mules, as under proper conditions they should be harnessed, close as possible to the draught-pin, we see that it is impossible for them to pass the posts until they turn inward in a

direction which reduces its effective length down to three quarters of its original.

In No. 5 we are still on the same lever in the same house, but in this we have moved the mules off some four feet farther; and yet, though in doing so we oppose the abnormal by the abnormal, we find we make an effective lever longer by several inches than to-night under your gin-stand.

In No. 6 we have a sixteen-foot lever in a thirty-eight-foot house. In this we let the swingle-trees off some eighteen inches, as in No. 1, and find that by doing so we again stumble into the abnormal, and shorten the effective lever, according to our line *d*, some ten inches.

In No. 7 we have the same lever and the same house as in No. 6. But here we harness close up to the draught-hook; and by this closeness on this lever, and in this house, we arrive at last at the highest practical maximum of power to be had from mules pulling on a circumference. And now, sir, in what direction do you wish me to say anything further?

Planter. If you please, in the direction of a comparison between Nos. 2 and 7. I want to see which I should adopt for my new gin-house.

Visitor. What is your impression?

Planter. On a fourteen-foot lever, in a thirty-four-foot house, there is a loss of seven inches; on a sixteen-foot lever, in a thirty-eight-foot house, there is a loss of about five inches; but in the latter it will take the mules a longer time to go round. This will cause a loss

of speed to the gin-saws, and I am under the impression therefore that in practice we must adopt the fourteen.

Visitor. Does the longer one in any irremediable sense bar the speed?

Planter. No; we can drive the mules a little faster.

Visitor. Is there no alternative?

Planter. Yes; I presume we can make some change in our running-gear.

Visitor. Exactly. Our ten-inch diameter gin-saws turn, or should turn, say two hundred and seventy-five times a minute, and we give them this speed with a walk of say two miles and a half an hour of the mules; our points then are two and a half miles an hour and two hundred and seventy-five revolutions a minute. Power and motion are equivalents. We will not now go into a calculation, but will take it for granted, as I believe we may with safety, that the equivalent of the two hundred and seventy-five is one hundred and twenty thousand pounds applied directly to the saw-shaft pulley. But it is not practical to apply this thus directly, and so we step back and send it indirectly through the intermediates of a steam, water, or horse-engine. But now we must apply a number of pounds additional—a number greater or lesser, according to the folly or wisdom or necessities of the intermediates. I say this because it is possible to have intermediates so unwisely designed that the application of three hundred thousand pounds would not reach the saw-shaft but as the necessary one hundred and twenty thousand. But a loss of some measure is inevitable, and to bear in mind reliability

and convenience, and discover the minimum of this measure, is the duty of the mechanician.

This loss is of three kinds: first, friction; second, unnecessarily abnormal, and third, necessarily abnormal lines of application of the power. In your gin-house we have all three of these, and our work now is to thoroughly eliminate the second—that is, the unnecessarily abnormal. We can not remove the third. To do so, under our necessity of applying our power at angles other than right-angles, is impossible; but we can resolutely refuse to give up an ounce more than can be wrenched from us by this third, this necessarily abnormal. With a lever of sixteen feet, and a right harnessing and headway, we have proved this to be about five inches; and the question now is, shall we accept this and, because of the larger circuit, allow the saws to run a little slower, or accept it and cause the mules to walk a little faster? I answer that we will accept it, and neither allow the mules to walk faster nor the gin-saws to run slower, because we will either by proper gearing increase the revolutions, or by proper lagging enlarge the diameter of the main-band pulley, so that the mules can still quietly keep on their two and a half miles, and at the same time, and with this least possible loss, give the saws the full two hundred and seventy-five revolutions as required.

If you ask whether there be any loss in this changed size or revolution of the band-wheel, I may answer truthfully, none whatever. The two inches of effective lever gained is a clear advantage, or at least an advantage

with a reduction by the radicals (that is, the roots or theories of our mechanism) so infinitesimal that it may with the highest wisdom be overlooked.

And now comes the time to speak of another advantage in this lengthening of our levers. If you want an animal to pull all that he can, and as easily as he can, you will let him pull on a line on which each of his feet will make a step which will be the measure of its fellow; and also, and apart from this, you will let him pull straight forward. But in a gin-house this equality in his steps is impossible, because, whether on a larger or lesser circumference, his inner feet in each revolution must pass over a line six feet three inches and a fraction shorter than the line passed over by his outer ones. But in a radius of fourteen feet this six feet and a fraction covers a line of only eighty-seven feet; whereas on a radius of sixteen feet it extends over a line of a hundred; and his steps are therefore nearer an equality on the longer than on the shorter radius. And again: the shorter the lever, the shorter, the more sudden, and the more painful are his twistings inward, and the more frequently the continuity of his pull is broken into jerks that are evil, and evil continually; while on the other hand, as the lever is lengthened, his inward inclinations become gentle and imperceptible, until with a proper radius and a proper outside headway he quietly forgets that he is on a circle, and pulls with an absence of irritation and a steadiness and continuity most desirable.

Planter. I am convinced, sir—thoroughly convinced. But now, if you please, let us pile it on in mountains;

let us have the rays of the stars; let us have the arithmetic. First, though, let me give you a thought which is pothering me. Our gin-houses have no support between their walls. My house is thirty feet between these walls. Its floor must bear the weight and vibration of the gin and corn-mill, and at times thirty or fifty thousand pounds of seed-cotton; how then can it be other than, as you called it yesterday, an insane strata of immense logs, and how then can we put up a house thirty-eight feet without the use of logs still more immense?

Visitor. Let me quiet you on that point. We have a friend in Louisville who has made provision for the eternal removal of those logs. His plan is a single beam, ten by twelve inches, to run through the center of the gin-house, and ordinary floor-joist from this to the walls, as in a dwelling-house.

Planter. But such a floor will sag on the running-gear so that fifty mules can't turn it.

Visitor. It won't sag, for he gives us an iron pillar for its support under the center.

Planter. That must be nonsense, for the axle of the running-gear must occupy the center.

Visitor. Nevertheless his pillar will occupy the center.

Planter. Do you mean that he will give us a running-gear with an iron axle which he calls a pillar?

Visitor. I think he will call it a spindle.

Planter. Axle or spindle, it turns; and how can the floor be supported by a thing that turns, even though it be of iron, without the weight of the floor interfering with the turning?

Visitor. But it does n't turn—does n't turn any more than one of the pillars of the capitol at Washington.

Planter. Then I am nonplused.

Visitor. You see he puts this iron pillar in the lathe and turns off the lower part of it as round and smooth as a piston of a steam-engine. Then he bores the hub of the master-wheel of a horse-power to fit this turned part of the pillar. Then he puts this master-wheel on the pillar and supports it at a proper height from the ground by a substantial collar, which he fastens on the pillar immediately underneath it. And now then, when he turns this pillar up and sets it under the center of the house, won't the master-wheel turn on it just the same whether its capital supports a pound or a million of pounds? At a proper distance above the master-wheel he pierces his pillar transversely with a strong wrought-iron shaft, on one end of which he keys the pinion to be driven by the master-wheel, and on the other end of which may be, if you please, the band-wheel to drive your gin-stand. The upper part of the pillar is cast with side branches for the boxes of the bearings which support this cross-shaft. Thus he gives us then, all in one, a strong iron column for a steadfast central support for the gin-house, a reliable and accurately turned spindle for the master-wheel, and solid and immovable bearings for the countershaft, or shafts necessary to complete a perfect horse-engine.

Planter. Verily, sir, I think that after all you have kept the best wine for the end of the feast. Looking at our diagram No. 7, I can at once see that that new

horse-engine is destined to be a machine of exceeding usefulness. It may not be a great, but for us of the South it is certainly an important, invention. What is the name of the gentleman?

Visitor. I can not at this moment say; but I know he is one who remembers his father's name in old golden letters on a time-worn sign-board over the apposition, "Manufacturer," at a time when he thought that that word meant nothing but the spinning and warping and weaving of cotton. Cotton and its manipulations are therefore in his mind coeval with his childhood. But is n't this somewhat of a digression?

Planter. No such a word, sir, if you please. We are enacting a little poem this evening, and that bit of biography is one of the episodes of our epic. I understand now then that with the entrance of this new horse-engine on the scene we can build a gin-house of thirty-eight feet inside with as little lumber, and easier than with the old running-gear, one of thirty feet. So adieu to the potheration and on for the arithmetic—the superiority in pounds avoirdupois of No. 7 over No. 1 in yonder old tatterdemalion in the quagmire.

Visitor. Very well, sir; it will take but a few minutes. First then I will assure you that the power required to keep your sixty-saw gin doing its proper work is, on a reasonable calculation, a continued application of say six hundred pounds—that is, six hundred pounds applied during the movement of each twelve inches of the draught-hooks; but that this may be sufficient it must be applied, as we have explained, at right-angles

to the resistance. In a gin-house it can not be so applied; and in every gin-house there is therefore a loss corresponding to the angle of the divergence.

In diagram No. 7 this divergence causes a loss of five inches in a lever of one hundred and ninety-two inches; 5 into 192 goes—please pass me that scribbling-paper— * * * goes, in whole numbers, 38 times; then 38 into 600 goes * * * 15 times; so in No. 7 six hundred and fifteen pounds must be applied during the movement of each foot of the draught-hooks.

In No. 2 we lose seven inches in a lever of one hundred and sixty-eight inches; 7 into 168 goes * * * 24 times; then 24 into 600 goes * * * 25 times; and so in No. 2 six hundred and twenty-five pounds must be applied during the movement of each foot of the draught-hooks.

But in No. 1 we lose twenty-four in one hundred and sixty-eight inches; 24 into 168 goes * * * 7 times, and 7 into 600 goes within a small fraction of 86 times; and so in No. 1 six hundred and eighty-six pounds must be applied during the movement of each foot of the draught-hooks.

At two miles and a half an hour the hooks pass over two hundred and twenty feet each minute. In No. 7 the loss each minute will therefore be 220 times 15, which is * * * 3,300 pounds. There are sixty minutes in an hour, and the loss per hour in No. 7 will be therefore 60 times 3,300 pounds, which is * * * 198,000 pounds. Sir, just think of it; even under this best arrangement our mules are constrained to expend one hundred and

ninety-eight thousand pounds per hour of their strength more than would be called for were it applied at right-angles to the resistance. Let us remember also that this loss is the least possible at our command; that it is the smallest practically attainable minimum; that in it there is not an ounce of the unnecessarily abnormal, and let us then realize how much it is our duty to use our best understandings and our most watchful vigilance in taking care that our poor animals shall not be subjected to any greater than this one hundred and ninety-eight thousand pounds per hour, which is unavoidable.

In the No. 2 the loss per minute will be 220 times 25 pounds, which is * * * 5,500 pounds; and the loss per hour will be 60 times this, which is * * * 330,000 pounds; which is * * * 132,200 pounds per hour more than in the No. 7. Here then is the result of the comparison you desired between a house of thirty-four and a house of thirty-eight feet; namely, the demonstration of the loss of the strength of your mules, amounting to one hundred and thirty-two thousand pounds per hour in the lesser more than in the larger house—one hundred and thirty-two thousand pounds of strength of your mules lost per hour in the house and lever as in diagram No. 2, more than as in the house and lever as in diagram No. 7.

But in the No. 1 the loss will be per minute 220 times 86 pounds, which is * * * 18,920 pounds; and the loss per hour will be 60 times this, which is * * * 1,135,200 pounds. Just think of it, sir; in your gin-

house you are losing one million one hundred and thirty-five thousand two hundred pounds of the strength of your mules per hour.

Planter. Sir, I am astounded. Is there no possibility of mistake in these calculations?

Visitor. The only possibility is in our data of six hundred pounds; all the rest is clear geometrical and arithmetical demonstration.

Planter. And I think that data should be higher. I doubt if less than the continued application of seven or eight hundred pounds, applied at any best angle you please, would run my gin-stand.

Visitor. And that would show a loss greater than this some one and a seventh million.

Planter. But, good God, sir! multiply this by the ten hours in the day, and this again by the usual forty or sixty days' ginning.

Visitor. I think it would come close to the billions.

Planter. And multiply this again by the tens of thousands of gin-houses miserable as my own. Why, sir, the difference between No. 1 and No. 7 would give us, I verily believe, strength enough to plow every acre that will be plowed for cotton this season.

Visitor. Then let us resolutely adopt the No. 7. In it we have the least possible loss of the mules' power; the nearest possible approach to the normal equality of their footsteps; the nearest possible approach to that straight-forwardness of direction which, in its natural adjustment of bones and muscles and harness, give their strength unimpaired to the plow and wagon, and

the nearest possible approach to its transmission to the corn-mill and gin-stand undiminished, unmarred, untrammeled, untruncated. And thus, sir, if you please, endeth our little poem of the seven diagrams.

* * * * * * * * *

On the evening of the following day we were again seated at the same table by the same fireside, I having in the mean time made four other diagrams, covering the setting of the gin-stand, and general plans for the construction and internal arrangements of the gin-house. After a few minutes general talk, our more regular conversation was resumed as follows.

Visitor. I said yesterday morning that your gin is much too close to your running-gear. See this figure A. Here under the letter D is represented the drum or pulley of the running-gear, and under P is laid down the pulley on the gin-saw shaft, a little over twelve feet from the other, as I found them this morning by measurement in your gin-house. You see that the belt *t t* laps round the drum considerably over its center—laps round it to points which show nearly two thirds its circumference. But you see it does n't lap round the pulley P on the gin-shaft much, if any, over one third its circumference. It laps too much round the larger, where it is less required, and too little round the smaller, where it is more required. Then to overcome this abnormal you have to indulge a little more in the abnormal, and press the belt down round a greater arc of P by the application of those miserable things called

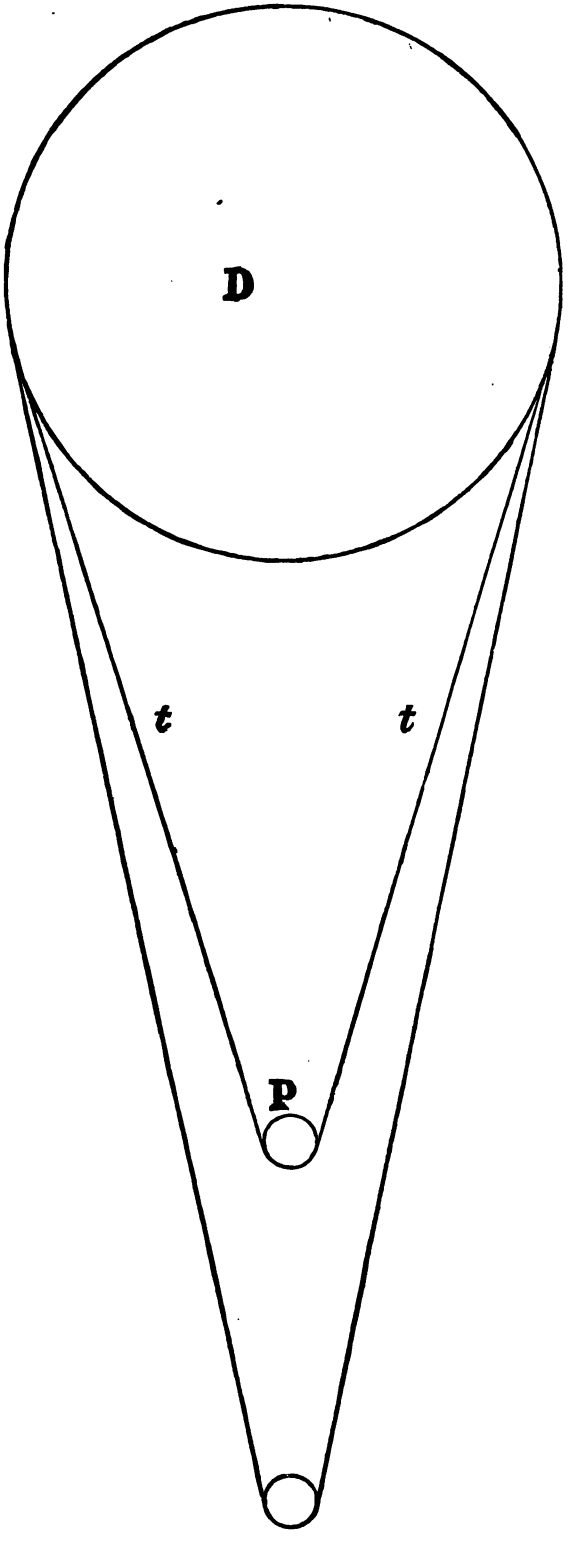


Figure A.

tighteners or binders. But look a little more to your right, and see the pulley P moved off some five feet farther. Now follow the lines of the belt, and you will see that it does n't lap nearly as much round the larger, and that it laps considerably more round the lesser pulley. At this distance of seventeen feet between the centers the belt, though loose enough to bar any loss by undue tension, will nevertheless do its work without a binder and, as you will find when you try it, with considerably less power. I know this to be so by experience. I know a case in which the roof was raised, a platform erected, the gin moved off six feet from its original position, a miserable old bumping tightener removed, a new belt put on which was, as all gin-belts should be, ten inches wide; and then with my own eyes I saw four mules run that gin as easily as six mules had run it the day previous.

Planter. This then is another good argument in favor of large gin-houses. And now, if you please, I am almost impatient to see those house diagrams.

Visitor. But before I uncover them let me give you my plan of framework. I abolish all tenons and mortices. I believe, when you come to tear down your house, you will find that these were the first to rot, and that they are now the most rotten things about it. Instead of them I recommend gains or boxings. I make timber grasp timber, not by a pin driven through one into an attenuated end of its fellow, but by locking them face to face solidly with shoulders, and then holding them together either with bolts or large oak pins driven

through and through, and when in, spread by wedges driven into their ends, to make them equal to bolts.

I would use no sills. These also are things to rot; but in the absence of rock I would cross-cut oak or cedar logs into pieces of thirty-six inches in length, and as soon as I had sixteen of these I would roll them into a pile and burn them till they were charred all over to the depth of perhaps an inch, and I would then use these for piers or buttresses for my posts. I would of course sink them into the ground sufficiently against frost, and leave their upper or bearing surfaces a few inches above the level of the plane contemplated as the properly elevated surface for the footway of the mules. I would have a workman adz and jack off their upper surfaces sufficiently convex to throw off the rains; and as another precaution against decay I would have these surfaces smeared with common tar, coal-tar, or asphaltum.

Here then is figure **B**, which is a figure of the outer or principal framework. You see I have twelve principal posts, numbered—and here please walk entirely round the house with me and read them off according to their numbers—1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12. These are to be each ten inches square, and fifteen feet and eight inches long, and to be connected, as you see—please walk round the house another time—by the girders A, B, C, D. These girders are each six by ten inches, and of a length to correspond to the size of the building. This, as we have decided, is to be thirty-eight feet in the clear square inside.

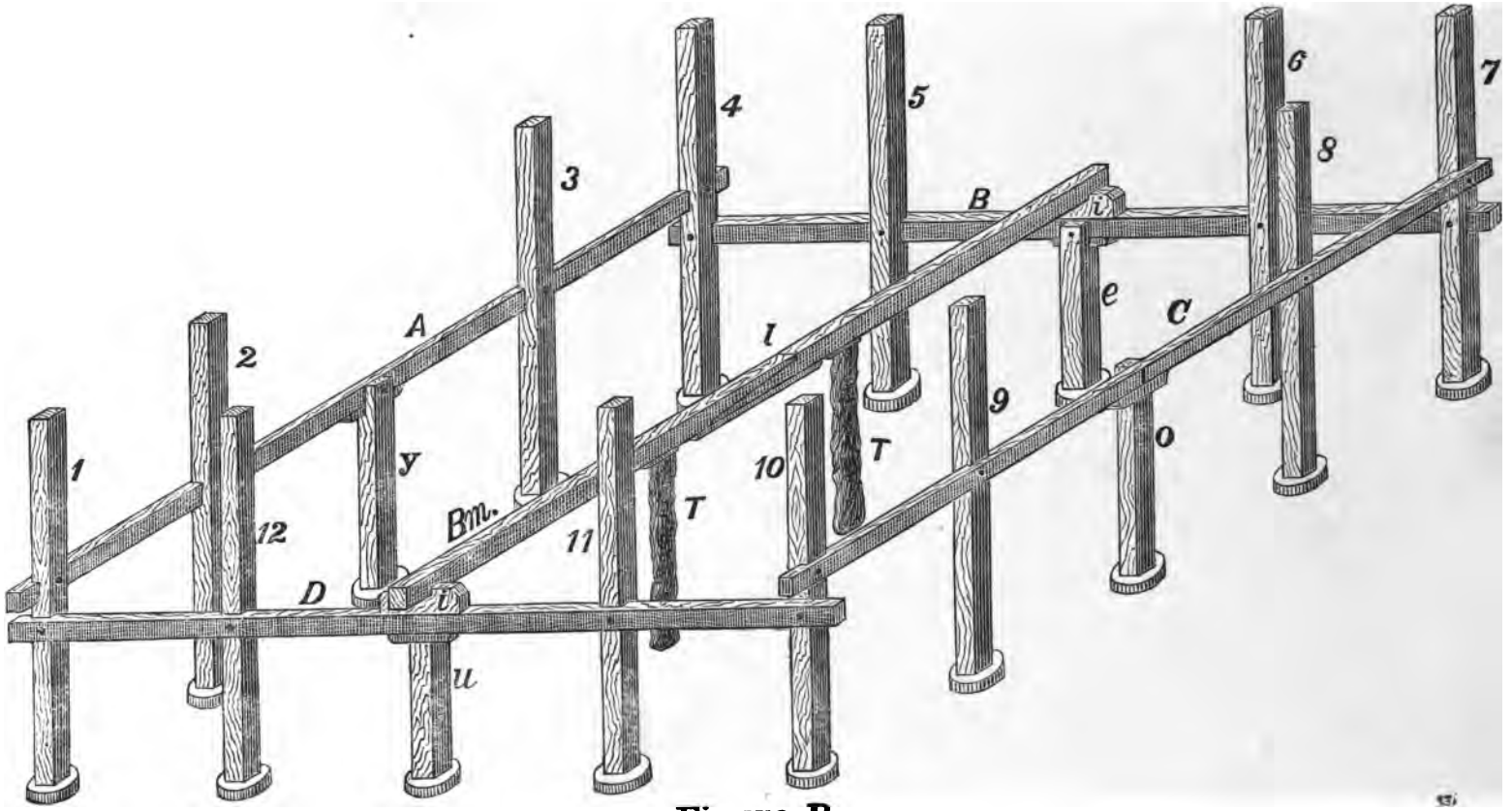


Figure B.

And at this point I thought of asking you whether, in your opinion, the three feet I have asked between the draught-hook and the posts for the free passage of the mules is more than is necessary?

Planter. Had you asked for those three feet, making, as they do, when we measure on each side of the house, six feet, the first words on your coming to my plantation, I would, I fear, have looked at you as an estray from an asylum; but now I say emphatically that they are not an inch more than is necessary. I assure you, sir, I will have no more duplications of the gnome of Balaam's ass in my gin-house. My foot has been crushed enough already.

Visitor. Very well then; we will go on with our thirty-eight feet square inside. The posts are each, as I said, ten by ten inches, so that from corner to corner outside will be thirty-nine feet and eight inches. This then would seem to be the length of each girder; but it is not, because I allow each to extend ten inches at the corner outside the post, as you see at post 1, so as to give a good shoulder to lock the framework part to part reliably together. We box into the girder an inch and a half for the post, and into the post two inches and a half for the girder; then bore through the center of their grasp with an inch and a half auger, into this drive a seasoned oak or hickory pin, fasten this in its place by driving a wedge into its center at each end, and this done we have made a fastening of girder to post and of post to girder which, if you but keep it dry, will last solidly a thousand years.

These ten-inch corner or outside shoulders will make each girder then thirty-nine feet and eight inches, and twenty inches, which will make forty-one feet and four inches as the length of each girder A, B, C, D. But as this would be an inconvenient length to make or handle, we will make the girder of each side out of two pieces, to be joined together in any way agreeable to the carpenter over the short posts *y*, *e*, *o*, *u*.

You see that girders B and D are boxed into the posts at points lower than girders A and C. This is done that their ends may pass each other as necessary for those corner shoulders, and also that we may avoid weakening the corner posts by making those two necessary gains unduly near to each other.

The upper surfaces or edges of girders B and D are each six feet and six inches from the lower ends of the posts, and the upper edges of girders A and C are each eight feet from the same points.

The beam *Bm*, which runs from girder D through the middle of the house to girder B, is to be ten by twelve inches, and to be raised sufficiently from B and D by the interjection of the bolsters *i* and *i* to make its upper surface and the upper surfaces of girders A and C on the same plane—on the same level for the reception of the floor-joist. This beam also is made of two pieces, which are to be joined by any form of locking recommended by the carpenter, as at the point I, over the center of the gin-house.

The iron pillar of our new horse-engine is six feet in length. The upper face of the block to be used

for its buttress is to be six inches above the line of the lower ends of the posts, or, in other words, eight inches above the level of the mule track. Six inches for the buttress and six feet for the pillar make six feet and six inches, which will leave room for a bolster-block six inches in thickness between the bearing-table of the top of the pillar and the under-surface of the beam. You see that the beam is now supported by temporary posts T T, which of course are to be knocked out on the setting up of the horse-engine.

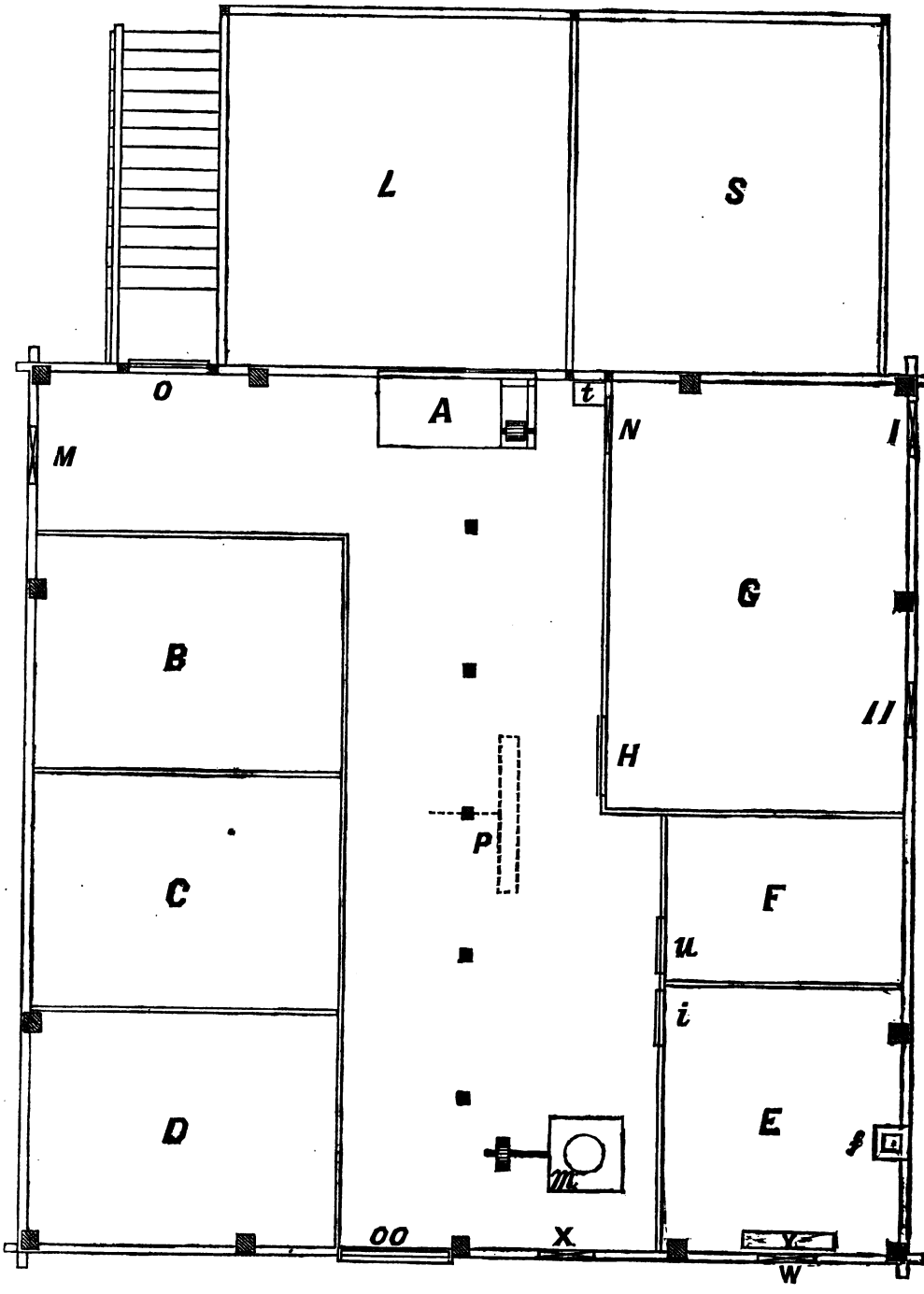
We have now gone through this framework until we are ready for the flooring. We can now then run a tier of joist, in size say three by nine inches, and, as we please, twenty or twenty-four inches apart, from the girder A to the middle beam *Bm*, and then a similar tier from this beam to the girder C, and we are ready for the flooring. Allowing this to be of inch boards, it will now be six feet and nine inches to the tops of the posts; and this, under a properly-projected and properly-covered roof, will give us a gin-stand room in which our servants can work as conveniently and as comfortably as in a comfortable factory. And at this point I might say that the machinery in a cotton-factory requires no better setting, no better light, and no better facilities for its most profitable attendance than does its primary machinery on our plantations.

Planter. And yet look at one of our cotton-factories and then at one of our gin-houses! But never mind, sir; there is a better time coming, and thank God!

Visitor. Your next work will be the plates along the

tops of the posts 1, 2, 3, and 4, and 7, 8, 9, and 10, for the reception of the rafters; and for the support of these plates between the posts 2 and 3 and 8 and 9 it will be necessary to erect stud-posts over the short posts *y* and *o*. If your carpenter pleases, he can, however, make these posts *y* and *o* like the twelve long ones, and so have no short posts but the two under the ends of the beam *Bm*. He had better perhaps set a lighter stud from the floor or girder to the plate midway between each two posts all round. I think these plates should be at least two and a half by ten inches; their edges should project one inch outside the posts, so as to correspond to the projections of the girders for the reception of the outside or weather planking; and I advise that you be careful that they are put on so that they can never possibly slip outward. I say this because once in my life I was annoyed by such a thing. I left the erection of a building, some twenty feet larger than this one, to one who was recommended as a good workman, and it was n't nine months until, under the weight of the roof, these slipped outward, and I was called an unskillful architect.

I presume that for the roof your carpenter will erect four principal rafters, with queen-posts and braces for the support of the necessary purloins: first, in the gable from post 1 to post 4; second, across above the middle beam from post 12 to post 5; third, across above the middle beam from post 11 to post 6; and fourth, in the gable from post 10 to post 7; and he will of course erect posts say six inches square from the



(6a)

Figure C.

middle beam up as central supports to girders second and third, and I may presume also that he will connect the ordinary rafters with collar-braces or beams, as is usual in a roof of the dimensions of this one. With this diagram in his hand, and these last few words I have spoken given to him as general intimations, he will easily understand all this, and I think get along better by himself than he would were we to pother him by thrusting into his hands drawings in detail, which perhaps he might find it difficult to understand.

Before leaving this part of our subject I should say, however, that the pulley of the horse-engine will be about eighteen inches from and parallel with the middle beam, and that therefore your gin-stand must be at the end with the girder either B or D. If then you want your lint-room on either the north or south side, you must have the girders A and C run north and south; and if you want it on the east or west side, you must have these girders run east and west. I presume I need hardly say that these figures you see under the posts are the buttresses I recommended.

Planter. I understand it all, sir. I believe I require but a little more familiarity with that diagram to be able myself to correctly oversee its erection. I assure you I am more than gratified.

Visitor. Here then comes figure **C.** This is a plan for the arrangements on the gin-stand floor, which, according to the size of our house as in figure **B**, is thirty-eight feet square. A is the gin-stand, and B, C, and D are seed-cotton bins, each ten and a half by four-

teen feet; *m* is your corn-mill, brought out from among the cobwebs and set to be run, if you please, by the belt borrowed from the gin-stand. I will, however, at this point hope that the time is not far distant when every planter will be able enough, as he should always be wise enough, to put up a countershaft at whatever convenient point between the two middle principal rafters, and from this run both gin and corn-mill with separate belts, as more desirable. F is a room nine by ten and a half feet, for a store-room for spades, shovels, hoes, and spare trace-chains and harness. G is an apartment thirteen and a half by seventeen feet, which, as it is to contain a work-bench and to be used for repair of implements, we will call a carpentry. L is the sixteen feet square ground-plan of the lint-room. S is the fourteen by sixteen feet ground-plan of a very useful receptacle for the proper care of the cotton-seed, which is to be shoveled down into it every few hours by the gin man's attendant through the spout, the mouth of which is seen under the letter *t*. And how much better it will be to have it thus taken care of, ready to be shipped to one or other of our new cotton-seed oil-mills, than to have it scattered as *debris* in offensively-smelling promiscuous heaps outside the gin-house.

Planter. Particularly when we consider, as I was thinking a few days ago, that four millions of bales give us three billion and several hundred millions of pounds of seed, and then remember that quite two thirds of this has been allowed to go absolutely to

waste—not even returned carefully as manure to the ground that gave it—I can see that our receptacle S is an improvement of considerable importance.

Visitor. I am glad, sir, that you approve of it. To continue: H then is the place of the door into the carpentry; I and I I represent the places of windows in it; and N represents a window in the partition throwing the light which passes through the window I in upon the gin-stand. M is a window throwing its light on the machine from the other direction. O is the place of the door by which we enter from the stairway outside. The dotted lines at P represent the pulley of the horse-engine in the mule-room underneath. X is the place of a window for light upon the corn-mill. O O is the place of a four or five feet wide door in the gable-end of the house through which the seed-cotton is landed from the wagons; *u* is the place of the door into the store-room, and *i* is the place of the door into the room E. This is an apartment ten and a half by twelve feet, and though it comes last is by no means the least important. It is to be provided with a substantial brick flue springing from the floor at *f* for the erection of a stove, with a window at W, with a table at Y, with a plain escretoire and a couple of chairs. It may seem that I am now going into the extravagant—

Planter. No, sir; I 'll allow myself to be damned if you are; you are now saying one of the wisest things you have said for the last three days. In my dreams of what should be, I have often thought of such a

sanctum. Here I am on broad five hundred acres without an inch of God's room into which I can retire and feel myself my own. To be sure, here is this parlor, and up stairs are those bed-rooms, but these are not mine—they belong to my wife and children. I want some little place where I can be at times alone, where I can think and plan and calculate. Unduly continued solitude may result in barrenness, but occasional retirement is necessary to fecundate the ovum and seduce it into conception. Conception is the thing, sir; not words haphazard at the moment your hands are waiting for directions, but words quietly giving plans quietly conceived in a quiet sanctum the day or evening preceding. Then too the location of an office in the gin-house during the time of ginning would be of great benefit. The knowledge that there is in the building a comfortable room, within the spring-locked door of which the master may at any moment be seated, would call up and confirm habits of activity which during the season would, I believe, tell in dollars numbering up to hundreds. Once this winter I plucked up courage to stay about my gin-house consecutively for five hours, and the result of my simple presence was two hundred and fifty pounds of lint that day more than any day before or since. A few times since that day I have tried to stay again, but at each trial I found it cold or wet or dreary or desolate; and by the Lord, sir, in less than an hour I sneaked off, and, like a whipped hound, hid myself, and that too probably growling, under my wife's petticoats.

Visitor. Then I need say nothing as to the wisdom of our little room in the corner by the grist-mill.

Planter. Devil the syllable, sir; devil the syllable.

Visitor. Some, however, may object to a stove even in an inclosed room in a gin-house.

Planter. To San Domingo with all such! We have stoves and fires in places of more importance—in our dwelling-houses. I would wager you, sir, a thousand pounds that the wise officers of our Planters Insurance Company of Memphis would take a risk on this house with its comfortable provision for the more or less continual presence of its master quicker than they would on a house which frightens him away with its raw ribs shrieking continually, Pneumonia! pneumonia!

Visitor. This then being all settled, we will take up diagram **D.** This is an elevation of our house on the side showing the window M shining in upon the gin-stand. Here you see also, on your left, one side together with the line of the roof of the lint and seed-rooms; also the stairway leading to the entrance through the door O; also the door and two of the four sliding half-windows looking into the mule-room, as talked of in our first conversation of yesterday. You see also that forty boards twelve inches wide and sixteen feet long cover one side of the house, and that this will make one hundred and sixty, plus perhaps twenty for the gables within the lines of the roof, for the outside sheeting for the entire building. But I think I will send you a bill of all the lumber necessary for the

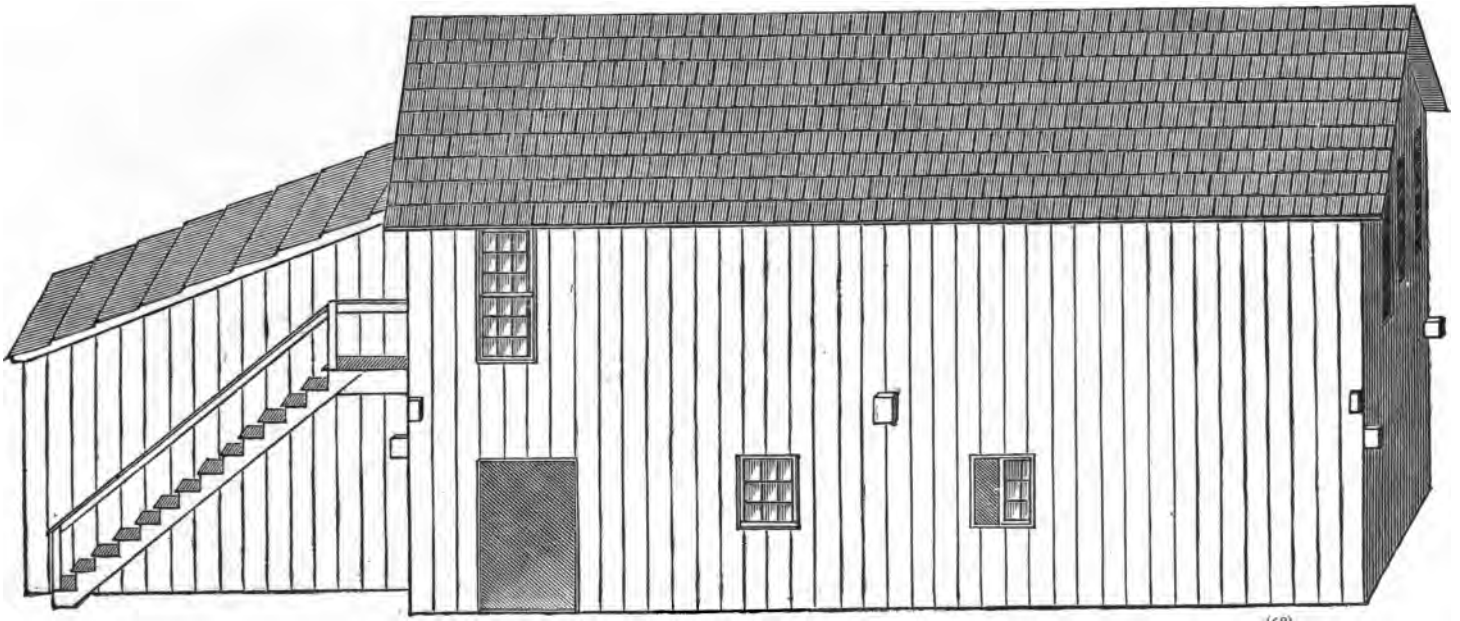


Figure D.

whole house, in the way of an appendix, as soon as possible after my return to Louisville.

Planter. Thank you, sir—thank you. And now, if you please, I have but another question to ask, and that is as to the costs. For myself I am determined to have these improvements. Three or four bales of cotton will, I conceive, cover the difference between this improved house and running-gear and the new erection of an old-style house and old running-gear, and these are but a small item compared to the superiorities. But I want to see these improvements not only on my own but on all plantations, and as so many of our planters are both poor and short-sighted, I wish to judge of the probability of their general early introduction.

Visitor. Leaving aside your qualification early, I am quite sure that their general introduction is as certain as anything in the future can be. I will speak more positively, I will say as certain as to-morrow's sunlight. It will be gradual, will be more or less slow or fast, as wisdom or short-sightedness may be the governors; but you may be sure that in good time it will be general—just as general as the wise and beautiful farm office-houses of the most advanced districts of Scotland.

As for the house itself, leaving out those partitions and the windows, it will not, I think, cost any more than one of those old monstrosities, and it will last four times as long. Those eight 8 by 10-inch pane windows—which I would have even if, instead of glass,

they were made of silver—will cost, boxed and delivered at Davis & Stort's Planing-mill in Louisville, not over twenty dollars. These, remember, will require no casings, but simply plain studs nailed in above and below for frames. But we may include the windows and the partitions and the work-bench, together with the chimney, stove, table, and chairs in the office, and then add whatever cost of the new horse-engine greater than the cost of the old, and I believe that I can conclude with you that the difference between the old and the improved will not exceed four bales of cotton, even though it be worth but fifteen cents a pound.

In reference to whatever greater first cost of the new horse-engine, I would say, in the first place, that without it this improved house, long levers, and clear headway are impossible; in the second place, that its plan secures an absolute continuance of its perfection until some time in the days of our children its iron pillar will be clothed with a renewal of its mill-work; and in the third place, I would remark, that a planter does not hesitate to give fifty, seventy-five, or even a hundred dollars for one mule more than for another; and that then in every case, in the good time coming, in which he is wise enough to recognize the truth that his gin-house running-gear is but a continuation of the bones and muscles of his mules, he will allow himself to be governed by the same common sense in the selection of this running-gear which governs him in the selection of his mules. This I think is a thought worthy of consideration.

Planter. It is indeed; and particularly when we consider that if he pays seventy-five or a hundred dollars for one mule more than another, he can have an advantage from that greater payment only through whatever greater strength and endurance in one mule; whereas if he pays one or two hundred dollars for this new horse-engine more than for the old, he will have the benefit of this greater payment in an increased strength and endurance imparted to four mules. This is indeed, sir, a thought worthy of serious consideration. I feel much gratified; I feel much encouraged. Improved running-gear and improved gin-houses will make an inviting vista to improved plantations. Sir, we shall yet prosper. We shall yet be free. God make us worthy! God bless our South!

APPENDIX.

Being a Bill of the Lumber for Improved Gin-House, as in Text.

16 pieces Oak or Cedar Logs, each 36 inches long, for Buttresses 14 pieces Oak, Poplar, or Pine, each 10×10 in. and 15 ft. 8 in. long 2 pieces Oak, Poplar, or Pine, each 10×10 in. and 6 ft. 6 in. long, for Posts under Girders B and D,	These, if sawed, will contain....	1,936 ft.
8 pieces Oak, Poplar, or Pine for Girders A, B, C, D, each 6×10 in. and 22 ft. long		880 ft.
2 pieces good Oak for Beam Bm, each 10×12 in. and 22 ft. long—if sawed, will contain		440 ft.
40 pieces Oak, Poplar, or Pine for Floor Joists, each 3×9 in. and 20 ft. long		1,800 ft.
4 pieces Oak, Poplar, or Pine for Eave-plates, each 2½×10 in. and 21 ft. long (if thought better they may be 3 in. thick)		175 ft.
8 pieces Oak, Poplar, or Pine for Girders or Tie-beams of principal Rafters, each 6×8 in. and 21 ft. long		672 ft.
10 pieces Oak, Poplar, or Pine for Top-chords for principal Rafters, for Posts from Floor to Tie-beams, and for Purloins, each 6×6 in. and 21 ft. long		630 ft.
80 pieces for Studs between main Posts, for Window and Door Studs, for Roof and Rafter Braces, also for Lint and Seed-room roof Rafters, and for Wall Studs and Floor Joists for these rooms		1,800 ft.
64 pieces for Roof Rafters for Gin-House proper, and for Partition Studs between Lint and Seed-rooms, each 3×5 in. and 14 ft. long..		1,120 ft.
475 boards, good inch thick, 12 in. wide and 16 ft. long, for Flooring, outside Planking, Rafter Collar Beams, Partitions, Doors, and Ceiling for Office, and for Ceiling over Horse Engine		7,600 ft.
200 boards, good inch thick, inferior quality, for Sheeting for Roofs		3,200 ft.
16 pieces for Stringers to which to nail Planking round the Mule-walk, and for extras, 4×4 in., 16 ft. long		342 ft.
Total, Lumber		20,595 ft.

In the above, except in the beams and larger girders, there is a fair margin given for extras.

To cover these buildings, including Lint-room, Seed-room, and Gin-house, will require about 22,000 shingles. The nails required will be say three kegs ten-penny, one keg twenty-penny, one keg four-penny, and say fifteen pounds two and a half inch long clinch nails for doors. The hardware required will be six pairs ten-inch strap-hinges for the four outside doors (that through which the seed-cotton is put in from the wagons, that into the mule-room, that into the seed-room, and that into the lint-room), and for the store-room and repair-shop doors; also latches and locks for these doors as may be deemed necessary; also a pair of butt-hinges and a spring-lock for the door of the office.

(See second letter in the prefixed correspondence.)

SUPPLEMENT:

CONTAINING INTERVIEWS WITH A FEW OF OUR COUSINS OF THE LARGE, BUT IT IS TO BE HOPED NOW HAPPILY DECREASING, FAMILY OF THE MOSIES.

Some say that people have surnames from some lost or forgotten association or peculiarity. The association may be lost, but in my opinion the peculiarity mostly continues. Sometimes, however, the name and the peculiarity become separated. Thus for example, I am sure my family name is not Mosie; and yet when I was a boy my father used occasionally to frown at me, and then with a passing shadow on his face growl at me, "You Mosie." There was no family of that name in our parish, nor did he ever tell me of one, or of any of its peculiarities; and yet whenever he said these words I knew that he saw my hands or feet or eyes or head, or perhaps all—hands, feet, eyes, and head—gadding as surely as I knew that I was living. I knew that the characteristic of a man of this family was not to give due attention to the work under his hands; not to know, and to feel that he did n't care to know, anything about the roots or radicals or nature of that work; to be more or less in the state of a simpleton, wandering through the woods, with his hair and unconscious films over his eyes, entangling himself among all kinds of bramble, and stumbling now on innocent horned frogs and now on ferocious crocodiles.

Were I to indulge in early reminiscences I could doubtless give you many autobiographical illustrations of the peculiarities of the Mosies; but perhaps because I think I am less of a Mosie now than I used to be, or perhaps because I would rather point to the hair and films over the eyes of others than to any, either in the past or present, over my own, I will give you a few other illustrations.

During the months of May and June last past I called to see a few of those horse-engines spoken of in the text as foregoing. At the place of my first visit the owner of the engine expressed himself well satisfied, although after running a few weeks he had to put on, he said, a fifth mule. After assuring him that so far as anything in the engine was concerned that was unnecessary, I learned that one day the main belt began to run off the pulleys; that to keep it on he first nailed a board against its edge, and then took an old idler and nailed it to an extemporized frame-work slanting fashion against its face. Then he had no more bother, he said; but he found that from that time his machinery worked harder, and so found it necessary to put on the fifth mule. Now why did n't this gentleman see

that the running off of the belt was a certain indication that either his engine or his gin-stand had twisted out of line? Why did he not know that the instant the pulley-shaft of his running-gear and the saw-shaft of his gin-stand shifted in the least degree out of parallel with each other the belt must run off, as surely as the earth must turn that we may have night and morning; and why did he not possess the more common knowledge that an idler is not made to hold the belt *on* the pulleys, but simply to hold it *to* them sufficiently to do its work? Why didn't he know that all that he had to do was to see that his two shafts, as above, were level, and then to simply move one or the other corner of his gin-frame round a little until the belt showed no tendency to deflect, and then to fasten that frame to the floor, and dismiss that fifth mule to his pastures? It was because he was, as, alas! I sometimes am myself, somewhat of a Mosie.

On another place I found an engine that had been run four months successfully: first, as a running-gear for ginning cotton; secondly, and at the same time, as a mill for grinding foul grease and dirt and cotton-seed; and thirdly, and at the same time, as a machine with powerful parts, pressing this filth, hardened like cement, into its cogs and bearings, and thus adding twenty per cent. strain on the miserable quadrupeds whose superior spiritual eyes saw their owner when he occasionally visited his gin-house, with his hair down to a degree which made them vote, one night in solemn conclave, that when the good time comes in which mules will be masters of all such men they would, as in duty bound, make him Grand Mogul Emperor of all the Mosies.

"Mr. Mechanician," said another gentleman, "this new horse-engine is a grand success." "Then you run the season with four mules satisfactorily," I said. "No; I run with six; but I am well satisfied," he replied. "But I know you should have run with four, and therefore I am not satisfied," I responded. "Then I'll tell you why I am," he said. "I have run gins for twenty years; I used generally the old running-gear, though a few seasons I used steam-power. I never run a season with the old running-gear that I did not have to stop and fix, and stop and wedge up, and stop and wedge down, and stop and patch in this, that, or the other place, until sometimes my soul felt as though under the harrows of the good man David when through the clay and stones he harrowed the flesh and bones of the children of the Philistines. And even with steam-power I would sometimes have to stop a week, and send to a machinist or boiler-maker, one or three hundred miles away, for some little cock or valve or patch, until with botheration my eyes felt like turning into cocks, squirting water to drown all the boiler-makers and machinists in the world. Ugh! if you knew how I used to be tormented, and then realize my peace last winter when with this horse-engine I ginned three hundred bales without a creak or crack or jump, without a pause or the shadow of a call for a pause, you would feel and say that verily I should be satisfied." I asked to see this engine, and when on the road to it we passed a little out of our way to see a duplicate of it, which he said had run the season with four mules satisfactorily. We found that the hand laid on the pulley of this one turned it almost like an old

spinning-wheel. He smiled, and presumed that two whole hands could n't turn his as easily as that; and when I asked him why he thought so he said it must be so, because this was worked by four while his required six mules. "But is it not possible that the extra mules may have been called for by something wrong outside the engine?" I asked. He did not know. He had not thought about that. "But here is one, the exact duplicate of yours, that has run a gin as large as yours with four mules, as you have told me, satisfactorily," I said. "Then there must be some evil in mine which is not in this one," he responded. But when we entered his gin-house we found that his engine turned with the ends of his fingers on its pulley even more easily than that of his neighbor. He seemed surprised, but soon said that when the gin was put on, however, it then worked hard. Perhaps I spoke bruskly when I contradicted him; and as I then saw that he blushed rather into a fog I spoke more patiently, and explained that the running-gear before him might be likened to a pair of platform scales, on which we lay ten pounds and its little invisible parts move; we lay on a thousand pounds, I continued, and these parts, though carrying this increased weight, move in themselves just as easily as in the first instance; and nothing can change this until in these parts something allows itself to be unduly separated from its fellow, and then to show a thousand pounds on the index we may have to put two thousand on the platform. "With this illustration to start from, I will now show you," I said, "that what you said may be applicable to the old running-gear, but not to this one. Say thirty pounds on the end of that lever turns this one, so it is possible that the same number of pounds may turn the old one. But put any considerable seed-cotton on the floor above it, and, as you know by experience, some of its parts may move so unduly into each other that till you institute the wedging process ten times thirty may not move it. But you may pile all the cotton in your county on the floor over this gear and it can no more affect it than though you piled it on the solid earth a hundred miles away. Its iron pillar, centrally supporting this floor, forever removes that old-time botheration. Again: the old running-gear is built on a wooden axle, with its main driving-cogs screwed upon wooden segments supported by wooden arms and wooden keys and wooden braces, so that when the gin-stand is thrown on it part may sink from part until, in addition to the original pounds as understood, and the constant five hundred pounds net we will suppose needed to run the gin, you may have to apply, as in the imperfect scales, and as may be the degrees in which the parts leave their due positions, one, three, or five hundred pounds additional. But look into this running-gear and you will see that anything of this kind is physically impossible. Its central pillar remains, under whatever weight, always solidly the same. Its master-wheel, which turns on this pillar, can not move away or cant over from its proper place a hair-breadth; neither can these strong wrought-iron shafts, which with their journals are held, though moving, as solidly within its iron arms as my heart is held, though moving, within my thorax. You see that, like the parts of my body, no part of it can move from its fellow-part except by a crash which would stop all its

movements. It clearly follows therefore that if four mules on one of these machines, in the hands of your neighbor, runs a sixty-saw gin satisfactorily, and this or any other one which is its duplicate fails to do likewise, you must, by every power of common-sense, seek for the cause of that failure in some undue direction into which the mules are forced in their circuit, in a bad design or condition of the gin-stand, or in the mode or condition of the connection between it and the engine. And now, if you please, let us see how these things are in this gin-house."

A few minutes' examination then showed us that this engine was set unduly close to one end of the house; that there was less than twelve inches between the draught-hooks and the middle posts of that end, and that consequently the mules pulled in a direction worse than as in Diagram No. 1; also, that the gin was so near the engine that somebody had to unduly bend the belt under the heavy friction of a badly-arranged idler; that its every saw ground against a grate-bar; that the grate-bars were worn by some undue whacking against them of the lint at the points where the saws disappear in their passage through them with the cotton, until they were cut, at sharp angles, almost half in two; and finally, that the gin, though not old, was in a wretched condition generally.

Standing in another gin-house, its owner, looking at me with a sharp countenance, said he feared the new horse-engine was no account, because he had run six mules on it, he said, all winter, and had nevertheless never been able to exceed two bales a day. "Can you tell me how many times your mules walked round a minute," I asked. "Yes; I timed them a hundred times," he said. "They made two turns a minute." "And what is the diameter of the driving-pulley on your gin-stand," I inquired. "Eight inches," he replied. "And the pulley on your engine is, I know, seventy-eight inches," I rejoined; "eight into seventy-eight goes nine times and seventy-five one-hundredths; so your gin-saws turn this number of times for each revolution of that pulley. This engine of yours is one of the first manufactured, and I know therefore that its pulley turns sixteen times for one of the mules, so their twice a minute gives thirty-two of this pulley, and this multiplied by the $9\frac{75}{100}$ shows us that your saws buzzed at the first-class speed of over three hundred a minute." "O yes," he cried, "the gin runs like the dickens. Your engine gives tip-top speed; but still it won't turn out the cotton, and therefore I can not honestly wish its inventor success in its manufacture."

There was a little old donkey near the gin-house, and all at once I heard a braying that was terrific. The gentleman looked at him, and I looked at him, and saw him come close up to where we were standing. But he kept on braying, and breaking his brays into the most extraordinary cachinnations ever heard from the throat of a quadruped. "What the devil is the matter with you?" cried my friend. But the animal only kept braying the louder, and breaking and shaking his brays into articulations, which made the gentleman exclaim: "What, in the name of God, does this mean! Why, sir, he seems to be talking to us!" "I should not be surprised if he is," I answered; "I should not be surprised if he was telling us, what doubtless

all donkeys know, that if a gin has the usual speed—and yours had some twenty-five turns a minute over that—and fails to gin the usual quantity of cotton, the cause of that failure must be sought for not in the mill-work that runs it—whether that be horse, steam, or water-power—but where only it can be found, in the body of the gin itself." He flushed at first angrily, but immediately his natural grace came to his assistance, and then, in spite of the Mosie that blushed in every fiber of his countenance, he good-naturedly acknowledged the blindness of his conclusions, and wished the new engine every success imaginable.

My next call was on a gentleman whose business prevented him from living upon, and who very seldom visited, his plantation. His first words to me were that the new horse-engine for which he paid three hundred dollars was worthless. I replied that if he was not mistaken he should have those dollars returned to him; and to this he answered sharply that he was quite sure he was not mistaken. "Have you had a copy of the *Seven Diagrams?*" I asked. "Yes," he rejoined; "I looked into one, and saw some angular hieroglyphics, which told me that it was nothing for me to read. I would rather have the opinion of one working millwright than a thousand dozen of such books." "And you probably have had some such opinion?" I inquired. "Yes," he said; "I sent out a first-class ginwright, who reported all right about the gin-stand, and that therefore nothing could be the cause of the accursed heavy load on the mules but the damned running-gear; then I sent out one of the best millwrights in the state, who came back and reported that the thing never could be worth anything, because its driving-pulley is but six feet and a half in diameter, while the pulley on every old running-gear in the country is at least nine feet."

"Mr. Cotton Merchant," said I, "will you let me have five minutes with your soul in a state of 'Barkis is willin'.'" "If your design is to pierce me with yourself as a mechanician, I am not willing," he replied. "I know nothing about machinery, and it is no use trying to give me explanations." "Come, come," I said, feeling I was being called on by good angels to give him all the patience I possessed; "I want five minutes of your time, with your soul in that state, simply to do with your own pencil in your own hand a little simple ciphering." We then seated ourselves with more quiet feelings toward each other at his desk, and I asked whether he had any knowledge of the old gear spoken of by that millwright. "Yes," said he; "in the old long-ago I walked after the mules on them many an hour." "And do you remember having ever noticed the number of turns the pulley makes for one turn of the mules," I asked. After a moment's thought he said, "I think it was nine or ten." "Here," said I, "is a memorandum of one I made in passing an old gin-house yesterday: two hundred and nine cogs in the master-wheel, twenty-two cogs in the pinion, and the pulley eight feet ten inches, but we will now say nine feet, in diameter. Now please divide the two hundred and nine by the twenty-two." He did so, and called out the quotient, nine and a half. "Nine feet diameter will make, in whole numbers, twenty-seven feet in circumference," I continued. "Now please multiply twenty-seven by nine and a half." He did so, and

called out two hundred and fifty-six and a half; and when I asked him how many feet then the main belt traveled during one turn of the mules he said at once, and correctly, two hundred and fifty-six and a half feet. "Now then," I continued, "the pulley on your new running-gear turns sixteen times for one of the mules, and we will suppose it to be, as your millwright said it should be, nine feet, and then multiply its circumference not by nine and a half, but by sixteen—please; now multiply twenty-seven by sixteen, and then say, with a nine-foot pulley on this gear, how many feet your main belt would travel during one turn of the mules." He did so, and called out four hundred and thirty-two. "Very well, sir," I said; "I am sure that without any further knowledge of machinery than you already possess—and you already possess a good deal more than a few minutes ago you thought you ever could possess—you now see clearly that with the belt running four hundred and thirty-two feet in the same time that in the old gear it runs only two hundred and fifty-six feet, you would have to put on at least two more mules; and you must know that the gin-saws at this motion would ruin your staple for the spinners." His answer was a thoughtful face and a continued silence. After a pause I asked him to have the goodness to read the "Seven Diagrams" that evening, and to allow me to call on him again on the morrow. He responded that he would do so; did so; and met me on that morrow with a new countenance, and proposed that we should take the cars and accompany each other to his plantation.

We found his gin-stand one of which I would at once say—given its evidently required more than ordinary amount of power, given its required greater fixedness of parts, and given its required greater and more than ordinary discerning watchfulness on the part of its attendant, and it is then possible that it and its fellows may be made the success that doubtless its worthy manufacturers are deserving of. In looking at the one in question I perceived that its saws were given work to do upon this side of them and upon that side of them; that it had a brush here and a roller there, and another brush and another roller in another place, and, if I am not mistaken, another brush in another place; all showing that somebody had been very inconsiderate in selling it to be run with the same power that runs a gin with its saws doing work but on one side of them, and with but simply one brush for the removal of the cotton. It is my belief that a forty-saw gin, with this increased number of cylinders, will require nearly, if not quite, as much power to run it as is required to run a sixty-saw gin of the ordinary pattern; and if this class of gins will do truly what is claimed for them, and I can be reliably promised that more discerning watchfulness on the part of their attendants, I stand ready to co-operate with their manufacturers for their introduction when made in these proportions. But apart from all this, the one in question was in a miserable condition. The boxes of its journals had left their original positions, and its numerous cylinders were consequently standing against each other at angles which made it impossible for the cotton to pass through them except by pressures which could not other than throw an undue strain on the

mules; and, to make the matter still worse, I saw a couple of coarse scantlings extending from the floor to the roof, and between these an idler weighing some forty pounds, and sometimes, as its frame was doubtless caught between the jagged edges of those studs, bearing with the resistance of several hundred pounds against the belt running under it to the gin; and I saw too that the under-lead of the belt, as it passed from the gin to the engine, was turned out of its due direction by a beam against which it had fretted itself, until a number of inches face of the solid wood was worn perceptibly; and in addition to this, its edges on both sides were badly frayed, and one edge cut into in several places as by a hatchet. "Why this belt," I cried, "must have been chawed in this way by the teeth of the engine." Then going down stairs I saw, to my astonishment, that in spite of them being plainly visible in every engraving of the machine, and in spite of the plainly-printed simple directions accompanying it, the two large bolts to be put through its upper flanges and the middle beam of the gin-house had never been put in, and the pillar with its mill-work was consequently left to twist a little this way or a little that way, at its pleasure; so that the belt, in addition to those upper horrible pressures on it, had to be held on the pulley by planks nailed against the under edges of the floor-beams for that purpose; and even these could not prevent it from occasionally sweeping off into the cogs of the engine. "Verily, sir," said I, as soon as I could speak, "your overseer must have been a wonderfully wise man, and those two men under whose stupid conclusions you groaned all last winter as under a nightmare are worthy of crowns of martyrdom—worthy, I mean, under that time-honored system of planters leaving difficulties of this kind to negroes and others, instead of through an intelligent manhood leaning upon themselves.

In an hour from that time we stood in a gin-house not over three miles distant. Its owner, a man of sense and determination, stood with us. He showed us his horse-engine, which was in every part an exact duplicate of the one we had just left, set up as immovably as a mountain; showed us his gin in good condition, stationed at a proper distance from the engine, and run with a good ten-inch wide belt, without touching anything on either its edge or face, and without an idler; and then told us that he had ginned four bales a day all last season with four mules gloriously. "Yes, sirs," he repeated, slapping his thigh with a small riding-whip he held in his hand, "gloriously."

When, as the stars were coming out, the first gentlemen and I were again alone together I said to him: "Eighty-seven of these engines went into operation last season, which was the first of their manufacture. Seventy-seven of these have reported, as our friend said this afternoon, gloriously, and from the other ten I heard grumblings. Two of these were taken out and laid prematurely aside, because of impatience being added to noddle-headedness; and though it has taken me nearly two months in this hot weather to do it, each of the other eight, in which yours is included, I have now visited. One of these I found with a defect in its manufacture, and immediately ordered its purchaser a new one; and in not one of the

remainder did I find anything the matter more than is with yours, or more than is with that one we have just seen, and which, as Mr. Blank says, has ginned two hundred bales with four mules so satisfactorily. One I found with the draught-ends of the levers dragging on the ground, and foolish house-braces which turned the mules inward, almost as in Diagram No. 4. In another gin-house the truck-wheels on which the engine was shipped were lying in the mule-track, in places which forced the mules into a circuit at least nine feet in diameter less than they could have had had those trucks been removed. Another I found in a house of the unusually small dimension of twenty-eight feet between the posts, the draught-hooks almost touching these posts, and the mules consequently thrust into a circuit on which a walk of a mile and seven tenths an hour gave the gin-saws a motion of at least three hundred and sixty a minute. The honest man that run that engine had sense enough to see that his mules were carrying an unduly heavy burden; sense enough to shout 'ho!' at intervals and let them rest, but not sense enough, or rather not a sufficient quickness of intelligence, to enable him to discern wherein lay the cause of this undue pulling; not sense enough to write to the manufacturer for a driving-pulley of a lesser diameter suited to that unusually small house; to say nothing of the blindness which increased the evil by putting the draught-hooks so far out, and so forcing the mules into the misery of a still more and more limited circumference. And here," I continued, "is your case, or perhaps I should say rather the case of your engine. Sir, it is shameful. All last winter you were at the expense of six mules and men and boys doing almost nothing, while it wanted but the glance of a man of even average thoroughness to see that that to which your overseer and those other addleheads attributed that nothing was as innocent of it—as innocent, sir, as that moon now rising over those hill-tops." I then explained to him the characteristics of the respectable family as in the foregoing understood; made him see without much difficulty that his employees on that plantation belonged to that family; and that, taking into consideration his losses and torment, they belonged to it with a vengeance; nor did I let him escape without quietly pinning him to the fact that any man who has a plantation, and hears of trouble which is not in due time removed by those on whom he depends for its removal, and does not then go and with due intelligence see to it himself, had better either sell that plantation, or stand with disheveled locks and allow his soul to be branded with the truth that he too belongs to the race of the Mosies. God grant that any of the peculiarities of that race that still abides with me may soon utterly disappear, and that the entire family, vein and brain, bone, sinew, and muscle, may in good time in this world become utterly extinct.

And now, in conclusion, let me request every planter who reads this supplement to go back and read over carefully the second time the latter part of the thirteenth and the whole of the fourteenth, fifteenth, and sixteenth pages of "The Seven Diagrams."

MECHANICIAN.

LOUISVILLE, JULY 31, 1872.

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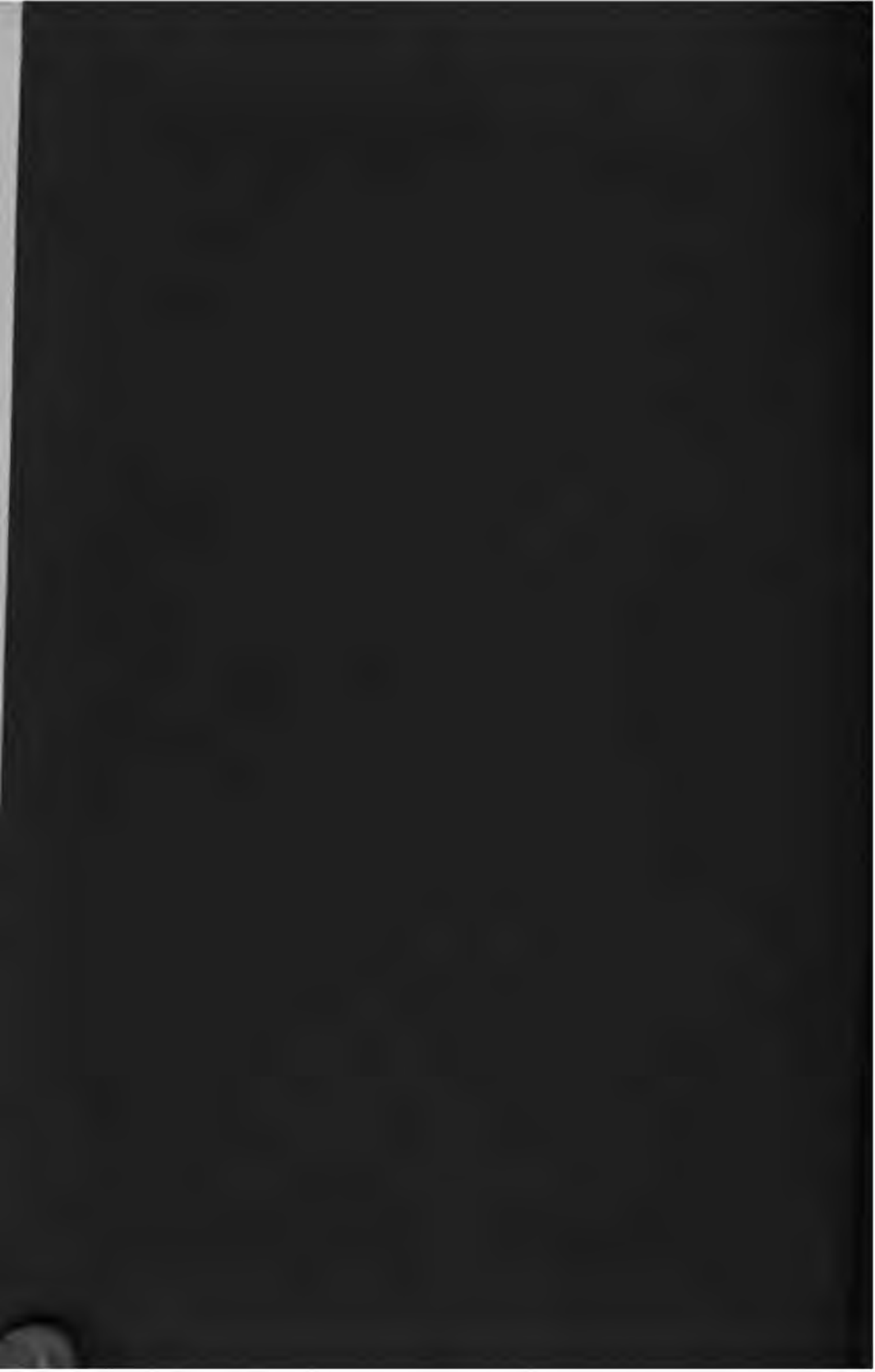

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